The Dock & Harbour Authority

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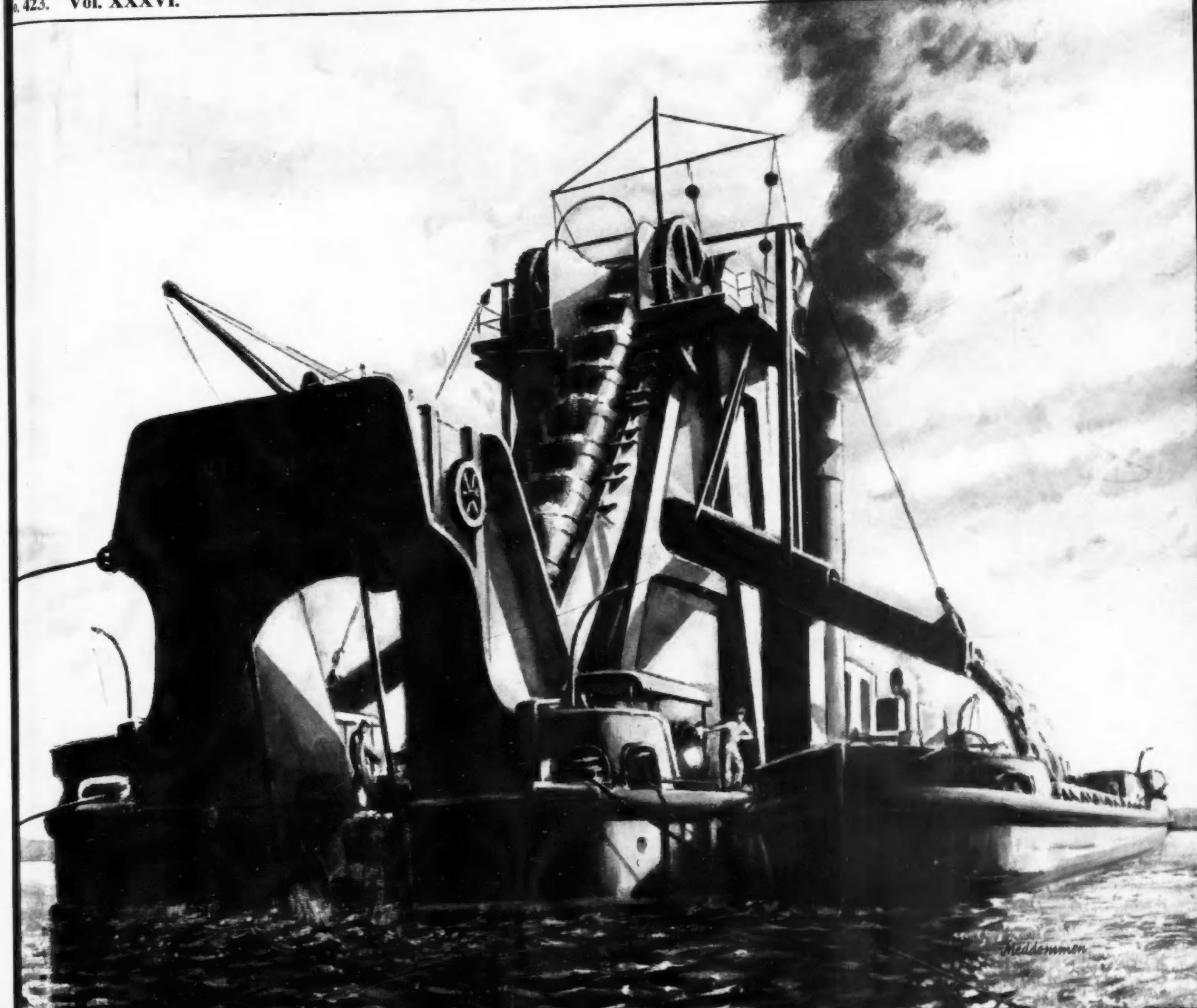

To Correspondents

All Letters and Contributions intended for Publication should be addressed to the Editor:— K. R. Doggett, Assoc.I.C.E., **"The Dock & Harbour Authority," 19, Harcourt Street, London, W.1,** and must in all cases be accompanied by the name and address of the sender.

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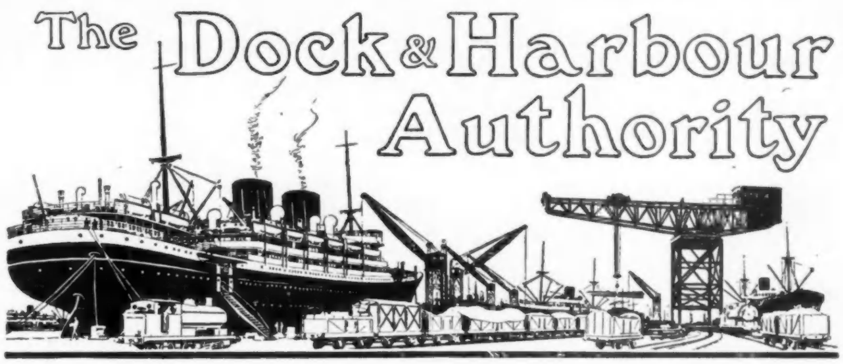

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The Dock & Harbour Authority

An International Journal with a circulation extending to 83 Maritime Countries

No. 423

Vol. XXXVI.

JANUARY, 1956

Monthly 2s. 6d.

Editorial Comments

The Port of Belfast

Belfast, the principal port of Northern Ireland, is perhaps best known to the world as a major shipbuilding centre. There is however a considerable and increasing activity both in the port itself and the industrial areas surrounding the city and in Ulster generally. Evidence of this is to be seen in the fact that the Belfast Harbour Commissioners, looking ahead, are planning to spend over £2,000,000 on improvements to the harbour and its approaches. This sum represents nearly £2 per head of the population of Northern Ireland, and such planned expenditure is a sure indication of the confidence of the authorities in the industrial and commercial prospects of Ulster in general and of the Port in particular.

The Harbour Commissioners are promoting a Bill in the present Session of the Northern Ireland Parliament, to take powers for developments which are or may be necessary in the Port. They consist of:

(a) The construction or re-construction of quays, wharves and jetties for cross-Channel traffic, viz., the coal trade, cattle trade and British Railways' cargo service. (b) The provision of a foreign dock on the site of Milewater Basin, and deep-water accommodation on the west side of Victoria Channel. (c) Various ancillary road and bridge works. (d) The provision of new dredging plant.

In addition to the Works clauses, the Bill covers proposed changes in the financial arrangements of the Trust with regard to borrowings and to Sinking Funds. It also provides for increases in the statutory maxima of certain rates and tolls, and seeks to confer further powers on the Commissioners to make bye-laws, including power to make bye-laws with respect to the control of traffic on roads vested in, or under the control of, the Commissioners.

Details of improvements since 1947, and of the proposed new developments are given in the leading article of this issue. It will be seen that emphasis is placed on the provision of increased facilities for railway containers and the ferrying of transport, in addition to a new quay for foreign trading ships, and bulk coal handling appliances. This latter is particularly important, since Northern Ireland's industry depends on imported fuel.

Centenary of "The Engineer"

One hundred years ago, on January 4, 1856, when the first number of "The Engineer" appeared, there were but few periodicals in this country which made it their business to record engineering developments and achievements. Its oldest contemporary is "Mechanics" which goes back as far as 1823, in which year it was started under the title of Mechanic's Magazine. There were also a few other papers devoted almost exclusively to civil engineering and building, to railways, to mining and to gas. Some of them, happily, are already in their second century, but the rest have long since ceased publication. In the mid-nineteenth century, however, it was evident that there was a place for a technical newspaper for engineers, and it was to fill that place that the "Engineer" was established.

From the start, the journal promised "strict impartiality" and declared that it would "take cognisance of all new works relating to the useful arts and allied subjects." It was in the firm belief that by the diffusion of knowledge new knowledge is evolved that "The Engineer" was launched. It is with pleasure that we record our congratulations to a Journal which for the past century has not deviated from the high principles enunciated by its founder. Internationally recognised and respected, its staff past and present have cause to be proud of its fine record.

Dock and Harbour Authorities' Association Studentship

We print on the next page a notice from the Institute of Transport regarding an annual Studentship to be competed for in the early part of 1956. The studentship will be awarded to the person who in the opinion of the Institute submits the best paper on a dock, harbour or conservancy subject during the year ending on April 30th, Dock and Harbour Authorities' Association are the sponsors of this scheme, and funds will be provided by the Association to enable the winner to study some aspect or aspects of the administration or work of a port authority in the United Kingdom. studies may take him to more than one port.

The Dock and Harbour Authorities' Association are to be commended for promoting research in this way, particularly as the port industry as a whole is not well endowed with study facilities compared with other industries. It is to be hoped that the endowment will act as a spur to ambitious port workers, who have thereby an opportunity both to extend their own range of vision, and at the same time to contribute to the knowledge of port working as a whole. Perhaps it would not be too much to hope that the Association's lead will be followed by other influential bodies. The provisions of the Finance Act regarding long term covenants are on the side of any such potential benefactors.

St. Lawrence Seaway Models

That the development of the St. Lawrence Seaway will have repercussions on the river as a whole goes without saying, and it is not unexpectedly that the Seaway Authority has announced the building of models to study these effects. It is now known that a contract for the construction of two models, for the purpose of studying the effect of the scheme on water levels and power potentialities in the Montreal area has been awarded to the Laboratoire Dauphinois d'Hydraulique (Neyrpic), of Grenoble. While there is no disputing the great competence of this famous French establishment, one may ask how it comes about that a problem in hydraulics existing within the British Commonwealth must needs be solved in a foreign country. It must of course be said that the Hydraulics Research Laboratory of the Department of Scientific and Industrial Research is a relatively new addition to the research potential of the Commonwealth. The resources of this establishment have however been much used since its inception for the study of Dominion and Colonial hydraulic problems, and it is surprising to learn that the St. Lawrence Seaway Authority did not approach the Department of Scientific and Industrial Research before awarding the contract in France.

Editorial Comments—continued

Centenary of the Royal Victoria Dock

Opportunity is invariably taken on the occasion of a centenary to look backward over the years to assess the degree of progress made, to refresh the memory, to consolidate experience and to check the course of current events so as to avoid a drift back to the shallow channels of the past.

The 19th century was the era of the building of enclosed docks in London for cargo handling and in consequence the 20th century has already provided, and will still provide, opportunities for reviews of past achievements.

Victoria Dock is the latest to celebrate its 100th anniversary and offers a most interesting subject for reflection. It is unique in several ways for it was the first dock in London to be rail-connected with the trunk lines of the country. It was also the first dock to be equipped with hydraulic power for working the machinery and it is the only dock in London which has been virtually re-modelled.

It was built by the Victoria Dock Company, on vacant marsh lands lying to the north of Woolwich Reach, at a comparatively small cost and unhindered by untoward difficulties in the construction.

Prospering business encouraged the promoters to consider extensions but in 1864 the dock was acquired by the London and St. Katharine Docks Company who opened the adjacent Albert Dock in 1880 and were granted the privilege of adding the prefix "Royal" to the names of both of their undertakings in this area.

The Victoria Dock was 94 acres in extent and was designed on a different plan from docks of earlier date, the north side having jetties at right angles to the quay. This was an unusual feature, taking into consideration the provision of rail access.

The layout of the dock was a severe handicap to its development but when the Port of London Authority which took over control of the dock systems of the Port in 1909 a long programme of modernisation was commenced. New tobacco warehouses, for the principal trade at the Royal Victoria Dock, were built on the north side and modern mechanical equipment for handling tobacco was provided for the older warehouses. Two highly mechanised berths for the discharge and direct delivery of South American chilled beef were also provided.

One of the most ambitious pre-war improvement schemes in the Port of London took place in the Royal Victoria Dock when the ends of the out-moded jetties were cut off and a vast reclamation scheme was carried out. A deep water quay over three-quarters of a mile in length and with modern rail facilities was constructed on the north side. The work was well in hand when the second world war started and the construction of five three-storied warehouses was actually completed during the war years. Further improvements have included the new sheds on the south side of the Royal Victoria Dock and the completion, too, of the modernised flour mills and adjacent quays which form a prominent feature.

The transformation of the Royal Victoria Dock from the elementary design of the mid-19th century to the fine modern ship terminal which it undoubtedly is to-day was an engineering feat of unusual interest and an authoritative article on the subject is being prepared for publication shortly in this Journal.

Marine Borers and Power Stations.

A brief article on marine borers and methods of protecting timber from their ravages appears in this issue. As the subject is of perennial interest, we make no apology for bringing it up again, mainly for the benefit of new readers. For a fuller treatment of the subject, the reader is referred to the December, 1952, issue of this Journal.

In these days of steel ships, the ravages of marine borers are, of course, mainly confined to timber dock structures, but in the days of wooden sailing ships the problem must have been acute, particularly before creosote and copper sheathing came into fashion. The problem of borers is one which needs to be faced at the outset, especially in warm climates. It is interesting to note that the Spanish Galleon "Duque de Florencia" which was built for the Armada was heavily infested with Teredo by the time she blew up and sank in Tobermory Bay in the autumn of 1588. Pieces of wood recovered in 1955 were riddled with bore holes caused by a Teredo of sub-tropical origin.

The problem of marine borers is tending to become aggravated by the increasing number of electric power stations which are coming into being on estuarial waters. Vast quantities of cooling water are taken, and returned at a substantially higher temperature; the effect is to upset the balance of nature and to create conditions in the estuary and in neighbouring port installations which did not previously exist. Among the by-products of the heavy consumption of cooling water may be mentioned the aggravation of oxygen deficiency, such as occurs in the River Thames, a Report on the pollution of which appeared in the May 1955 issue of this Journal. Another effect results from the creation of a new sea "climate," favouring the growth of marine organisms, some of foreign origin, which previously were no great menace to wooden pile structures. Certain estuaries on which large seaports are situated are already so filthy that marine borers are unable to flourish. This may be an accidental advantage, but it is undesirable and does not apply in those instances where the temperature is raised in the absence of severe pollution.

It is therefore gratifying to learn that the effect of cooling water is to be investigated at Southampton, where a large new power station is shortly to come into action at Marchwood on the River Test. An article outlining the research programme appears on another page. Still more commendable is the early co-operation of the Central Electricity Authority, the Southampton Harbour Board and the Zoology Department of Southampton University, in a long term investigation which by anticipating the opening of the power station will determine the conditions now existing in the rivers and in Southampton Water. A firm basis from which to observe the impact of cooling water will thus be established.

Topical Notes

Dock and Harbour Authorities' Association Studentship

The Institute of Transport has pleasure in announcing the availability of a Studentship offered by the Dock and Harbour Authorities' Association.

This Studentship is for the study at one or more ports of the United Kingdom of some aspect or aspects of the administration or work of a port authority, and carries with it a grant not exceeding £100 to cover the holder's expenses.

The Award will be made by the Council of the Institute of Transport for what in its opinion, is the best paper on a dock, harbour or conservancy subject submitted to it during the year ending on April 30th. (The Award would be withheld if no paper of sufficient merit were received.)

The period of the Studentship will not ordinarily exceed two months.

The Studentship is restricted to employees of dock, harbour and conservancy authorities in the United Kingdom and in the Republic of Ireland. The Dock and Harbour Authorities' Association will use its best endeavours to arrange for facilities for his studies to be made available at a port or ports selected by the successful candidate but reserves the right to arrange these at one or more other ports.

The method of payment of the grant will be arranged to suit the convenience of the successful candidate. The Studentship may be varied or cancelled should the holder cease to pursue his plan of study or should his work be deemed unsatisfactory.

Notes for the guidance of authors of papers may be obtained from F. W. Crews, Secretary, The Institute of Transport, 80, Portland Place, London, W.1, to whom entries should be sent to arrive not later than April 30th, 1956.

Alexandria Shipyard Scheme.

The Egyptian National Production Council have approved a scheme for the construction of a shipyard for the building and repair of naval and merchant vessels. It is estimated that the cost of the scheme will be £E3,600,000. The Council also decided that the Government should finance a scheme for the building of a dry dock over a period of four years, within the limits of a first estimate amounting to £E2,500,000.

The Port of Belfast

Recent Improvements and Plans for Development

By F. W. HAMPTON, B.Com.Sc., M.Inst.T.,
General Manager and Secretary, Belfast Harbour Commissioners.

IN 1947 the Belfast Harbour Commissioners celebrated the Centenary of their constitution and an article describing the history and development of the Port since the early 17th century appeared in "The Dock and Harbour Authority" in August of that year. Following the recent decision of the Commissioners to construct two new quays and to carry out other works, at a cost totalling over £2,000,000, this is an appropriate occasion to review the years since 1947 and to give some idea of the improvements shortly to be commenced.

New Quays.

The two new quays will be sited in the Herdman Channel—one on the East side which will serve foreign-trading vessels and one on the West side for the freight services of British Railways to and from Great Britain (Fig. 1).

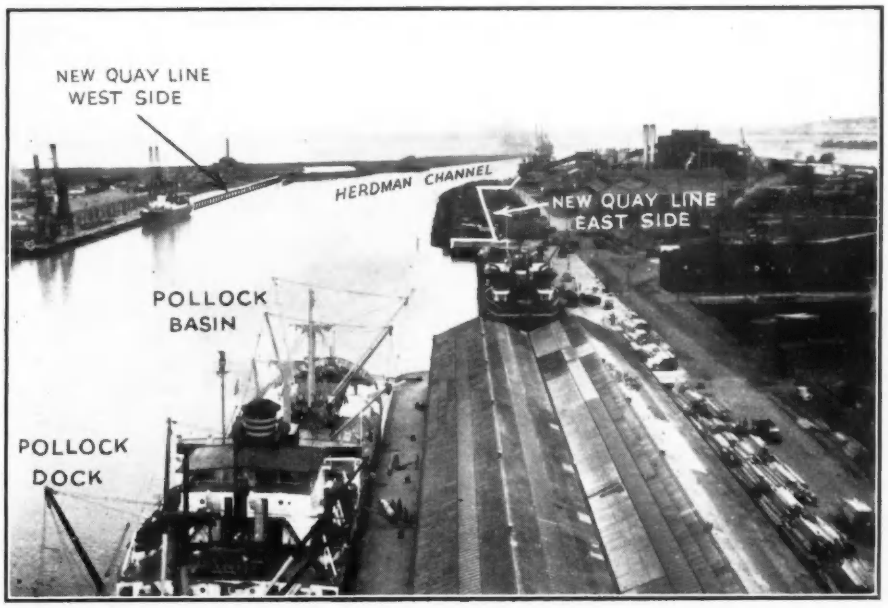
The Herdman Channel is the newest of the three main channels in the Port. It was cut in the year 1931 and quays were constructed at Pollock Basin and Pollock Dock at the City end of the Channel. In 1942/43 this accommodation was increased by the construction of a large deep-water quay on the West side of Herdman Channel and by the extension of the Pollock Dock system. These wartime works added 2,000 lineal feet of quayage to the deep-sea berthage accommodation and made a total quayage of over one mile in the Herdman Channel area. Three commodious sheds were also constructed.

The new quay for foreign-trading ships on the East side of the Channel will have a reinforced concrete deck supported on steel and concrete piles. It will be 1,250-ft. in length and will be equipped with a shed, 1,110-ft. in length and 120-ft. in width, together with railway lines and crane track. The berth alongside will be dredged to a depth of 28-ft. 3-in. below Harbour Datum (30-ft. at O.L.W.) and provision will be made for its eventual deepening to 33-ft. 3-in. below Harbour Datum, should such be found necessary at a future date. The work will cost approximately £1,100,000.

As a long-term scheme the Commissioners have envisaged the widening of Herdman Channel and the frontage of the proposed quay will conform to the new line of the Channel. The quay will be constructed in the "dry" and the required dredging carried out afterwards.

In order to provide the additional facilities for British Railways on the West side of Herdman Channel, the existing Herdman Channel Wharf will be extended Northwards by over 1,000-ft. This will give three additional berths with large transit sheds for the reception and sorting of cargo. The quays will be equipped with the latest types of cranes, and there will be ample open space for the handling of containers. Provision will also be made for the shipment of livestock. Apart from goods carried in their passenger vessels, which will continue to berth at Donegall Quay, all the cargo services of British Railways at Belfast will be concentrated at these new berths.

Containers, for which provision will be made at the new quays at Herdman Channel West, are being increasingly used for traffic to and from Great Britain. This quick and convenient service is proving attractive to merchants and gives greater security against breakages and pilferage. Vessels specially used for containers have been operating to and from the Port since 1949, and British Railways are building new vessels for this traffic. In addition to British Railways, there are regular services by Belfast Steamship Co. Ltd. and Messrs. Frank Bustard & Son, Ltd. A ramp terminal at Pollock Basin is used by the latter company for their transport ferry service to Preston.



Herdman Channel showing sites of proposed new quays.

Post-War Reconstruction.

The Centenary of the Commissioners in 1947 fell at a time when, despite the difficulty in obtaining materials, much work which had necessarily been deferred during wartime was being undertaken. Dredging, the repair and improvement of transit sheds and roads, replacement and extension of railway lines and other accumulated maintenance works were being tackled. Two years later, when most of the leeway had been made up, major schemes of reconstruction of some of the older quays and wharves were commenced, and this work is being actively continued.

The first large post-war work of modernisation was carried out in 1949-51 by the reconstruction of a portion of Queen's Quay. A new frontage for a length of 1,250-ft. from the North end was provided, and the depth alongside increased to 18-ft. 3-in. below Harbour Datum. This quay mostly caters for the coal trade (about 1½ million tons of coal are imported each year) and following the reconstruction it has been equipped with six new 5-ton level luffing travelling electric grabbing cranes. These cranes have a radius of 65-ft. as compared with the 50-ft. radius of the cranes they replaced, and a greater area of storage ground can, therefore, be utilised. They have also a much greater rate of discharge, and "combined digger-scraper" and "clamshell" grabs are used. In the course of carrying out the work soft ground was encountered and some of the piles had to be increased in length from 42-ft. to 72-ft. Last year, work was commenced on a similar reconstruction of a further 558-ft. of this quay and the work is well advanced.

The adjacent quays in Abercorn Basin, which also serve the coal trade, were refronted during 1951-54 and a greater depth of water provided so that the larger colliers now in use can berth at all states of the tide. On the East Quay (450-ft.) steel sheet piles were driven immediately in front of the existing timber frontage and the timber cope replaced by one of reinforced concrete. On


PORT OF BELFAST
Engineer:- Major J. H. A. PATTON, M.B.E., M.C., T.D., M.A., M.A.I., M.I.C.E.
PROPOSED WORKS
(1) Proposed New Quay for foreign-trading ships at Herdman Channel East
(2) Proposed New Berthage for use by British Rlys. ,, ,, ,, West
(3) Proposed Reconstruction of Albert Quay.
MAJOR WORKS CARRIED OUT SINCE 1947
(4) Reconstruction of Queen's Quay.
(5) ,, ,, Quays at Abercorn Basin.
(6) ,, ,, Delivery Wharf - Musgrave Channel.
(7) Re-frontage of N. Wall of entrance to Spencer Dock.
(8) Coal Discharging Wharf - Herdman Channel E. for use by Belfast Corpn.
(9) New Road to serve West Twin Island.
(10) Improvements at Milewater Bridge.
(11) Completion of Reclamation Bank at Garmoyle.
BELFAST LOUGH
HARBOUR COMMRS BOUNDARY
TIMBER POND
ULSTER TRANSPORT AUTHORITY RAILWAY
YORK ROAD
POLLOCK DOCK
POLLOCK BASIN
HERDMAN CHANNEL
WEST TWIN ISLAND
GOODS SHED
SPENCER DOCK
YORK DOCK
CLARENDON DOCK
ALBERT QUAY
BALLAST QUAY
DONEGALL QUAY
RIVER LAGAN
VICTORIA CHANNEL
ABERCORN BASIN
EAST TWIN
QUEEN'S ROAD
FITTING OUT BASIN
MUSGRAVE CHANNEL
AIRPORT ROAD
CONNSWATER
VICTORIA PARK
BELFAST HARBOUR AIRPORT
HARBOUR COMMISSIONERS' BOUNDARY
HOLYWOOD ROAD
N
Scale of Feet
Feet 1000 500 0 1000 2000 3000 4000 5000 Feet

Port of Belfast—continued

the South Quay (600-ft.) steel sheet piles were driven in front of the masonry wall and the space behind filled in with concrete and brought up to cope level. A crane track for heavy type cranes was laid—the front rail being carried on the masonry wall, which was reinforced and strengthened, and the back rail on reinforced concrete beams placed on top of cast in situ piles. One of the new 5-ton level luffiing cranes has been installed on the South Quay and a further crane is on order.

Almost half-a-million pounds has been expended to date on these improvements — £350,000 on Queen's Quay and £113,000 on Abercorn Basin.

Mechanised Coal Handling.

This modernisation of the coal discharging quays has been accompanied by increased mechanisation in the handling of coal by the importers. Mechanical shovels, conveyor belts, etc., are used extensively, and recently installed screening plant ensures cleaner household coal. Mechanical bagging plant has greatly speeded up the bagging of coal for delivery, and has also eliminated much heavy manual work (Fig. 2).

The facilities for the coal trade will be further enhanced by the reconstruction of Albert Quay on the Co. Antrim side of the Harbour, which will be commenced next year. The quay will be reconstructed on its present frontage by incorporating as far as possible portion of the present structure where sound, carrying out strengthening operations in reinforced concrete and driving a steel sheet pile face-work. The depth of water alongside will be increased to 18-ft. 3-in. below Harbour Datum and the quay equipped with five 5-ton cranes similar to the new ones at Queen's Quay and Abercorn Basin.

The Delivery Wharf, at which iron and steel are discharged direct into the Musgrave Shipyard of Messrs. Harland & Wolff, Ltd., was reconstructed during 1951-52 without interruption of shipments. The new design will permit of the berth being dredged to 21-ft. 3-in. below Harbour Datum, instead of the present depth of 15-ft. 3-in., should it be found necessary.

On the Co. Antrim side of the Harbour the North Wall of the entrance to the Spencer Dock was refronted in 1950-51. The entrance was formerly 175-ft. in width but it had the full depth of water of 21-ft. 3-in. below Harbour Datum for only 115-ft. Now, although the visible entrance has been narrowed slightly to 160-ft., it has the full depth of water for its entire width. This greatly facilitates the manoeuvring of large vessels using the Spencer, Dufferin and York Docks.

In 1950 an area of 14½ acres of the Board's vacant land at West Twin was leased to Belfast Corporation for the erection of an electric power station and, in this connection, the Harbour Commissioners have constructed a coal discharging wharf, 407-ft. long, with a depth alongside of 21-ft. 3-in. below Harbour Datum, on the East side of Herdman Channel. The frontage of the wharf conforms to the new line of the widened Herdman Channel previously referred to. The work was carried out in the "dry" and the wharf has been in use since October, 1954.

Road Access Improvements.

In connection with the further development of the West Twin, a reinforced concrete roadway (20-ft. wide) has been constructed from Milewater Basin, Dufferin Road, to the East side of the new power station—a length of 1,950-ft. When circumsstances require, the roadway will be doubled in width and have footpaths 15-ft. wide on West side and 10-ft. wide on East side. The new roadway is lighted by sodium-vapour electric lamps.

The landward access to the West Twin is by Dufferin Road, and the Milewater Bridge which carried the Dufferin Road over the channel between Pollock Basin and Milewater Basin was narrower than the rest of the roadway. To provide better access and to enable heavier weights to be carried, the bridge has been removed, the channel culverted and the roadway widened at this point, thus giving a uniform width of the roadway along the Dufferin Road.

The electric tramcar service operated by Belfast Corporation on Queen's Road to the shipbuilding and engineering works of Messrs. Harland & Wolff, Ltd., was discontinued in February, 1954, and replaced by an omnibus service. Subsequently, the tramway track was removed and the roadway was resurfaced in asphalt. The lighting of Queen's Road and adjoining streets has been improved by the installation of new sodium-vapour electric lamps, and traffic signals have been provided at the junction of Queen's and Sydenham Roads.

The setting-up of the aircraft industry in Northern Ireland was due in no small measure to the facilities of Belfast Harbour Airport. This Airport was constructed by the Commissioners out of materials from dredging and excavation work in the Harbour, and Messrs. Short & Harland, Ltd. were established alongside it in 1936. The Musgrave Channel, which flanks one side of the Airport, has enabled the Firm also to construct seaplanes. At berths in the Channel aircraft carriers, etc., can receive or discharge aircraft direct from the flying field, a facility which was much used in the last War.

Land Reclamation.

Spoil raised in dredging operations is being further utilised in the reclamation of foreshore on the Co. Down side of the Harbour and an area of 315 acres of foreshore was enclosed in August, 1954, by the completion of a reclamation bank at Garmoyle. The work of filling in and consolidating the ground behind the bank is proceeding.

Mobile Coal Screening and Bagging Plant.

Radio-telephone communication was provided in 1947 between the Harbour Workshops and the Board's tugs, motor-boats and dredgers, and a 24-hour service is now maintained by wireless telephone with the pilot light vessel "Lady Dixon," stationed about eight miles down Belfast Lough.

Belfast's Increasing Trade.

At the Annual Meeting of the Commissioners in February last the Chairman, Sir Kenneth Sinclair, D.L., said that, generally speaking, last year the Port had been working to capacity and that never before had its accommodation been used so intensively.

(Concluded at foot of next page)

Fixed Navigational Beacons

Prefabricated Structures for Rapid Installation

When the Admiralty forecast a requirement for a number of fixed navigational beacons in the exposed tidal waters of the lower estuary of the Thames, one of the more obvious answers to the problem was a piled dolphin. The water was comparatively shallow, the bottom was mud and sand, and the only loading was wind and wave action. The Thames estuary is, however, notorious for the rapidity with which a "dirty sea" can get up, and the lack of warning that can be obtained. From the onset the designers realised that speed of erection was vital, and to be successful the dolphin design must provide a structure of adequate strength which could be placed in a minimum of time.

First attempts at the design of a dolphin were based in four steel box piles with prefabricated "dumb-bell" bracings and walings surmounted by a deck of pre-cast concrete units. Difficulties could be foreseen in driving four piles with sufficient accuracy to receive the bracings and the deck units; the sites were up to forty miles from port; and the whole operation threatened to outlast the time of a normal reliable weather forecast.

Thoughts then turned to a completely pre-fabricated structure which could be placed on the sea-bed, and here the advantages of an all-welded tubular structure were realised. A structure was evolved which not only kept weight down to a limit at which transport was possible, but which offered a minimum surface area to wind and wave. Stability was obtained by "nailing" the feet of the structure to the sea-bed with tubular piles arranged to slide through tubular sleeves fixed to the feet of the structure, the tops being guided by heavy guide blocks fixed to the piles, partially encircling, and arranged to slide down guides welded to the corner membrs of the structure clear of the welded on bracings.

At this stage a model of the structure, which later was exhibited at the Institution of Civil Engineers Conversazione, was made to a scale of $\frac{1}{4}$-in. to 1-in., and the essential features of the design with the tubular piles attached to the legs of the structure and the three pile-driving hammers in position ready to start operations were all apparent (see Fig. 1).

The depth of water where most of the dolphins were to be placed was about 17-ft. at low water with a 15-ft. tidal range. The deck was designed to be at a minimum of 15-ft. above high water to be well clear of the crest of storm waves. A standard size which would be suitable for all these sites was aimed at and the 51-ft. 6-in. high structure shown with a 28-ft. 6-in. triangular base and 13-ft. 9-in. triangular top was found to suit most cases. Where there is a greater depth of water or the tidal range is greater, it is planned to provide extra height by bolting on an extension piece.

As soon as it became clear that a suitable design had been found, the method of transporting and placing had to be investigated. The weight of the frame with three 9B3 hammers in place is approximately 25 tons. A self-propelled craft with pile driving equipment was located which was able to handle the complete structure, and arrangements were then made to build and place a prototype beacon before embarking on the complete project.

The prototype frame was constructed at Chatham Dockyard in the Spring of 1954 and on 3rd May it was transferred by floating crane to the self-propelled pile driving craft for conveyance to the selected site. The craft proceeded to the spot the next day and was met there by a converted L.T.C. which carried the steam boilers for the pile-

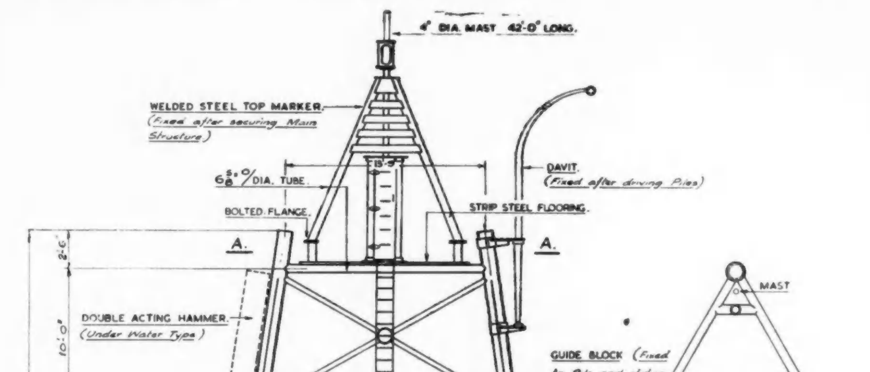


FIG.1. FIXED NAVIGATIONAL BEACON.

Port of Belfast—continued

An indication of the growth in trade in recent years is given by the following figures:

Year	Tonnage of Vessels Cleared.	Tonnage of Vessels Cleared.	Tonnage of Goods.
1938	4,544,612	4,451,609	3,615,564
1947	4,102,757	4,049,948	4,169,875
1948	4,725,658	4,091,946	4,221,045
1949	4,456,540	4,370,670	4,444,095
1950	4,836,246	4,624,404	4,632,025
1951	4,941,928	4,902,826	4,696,480
1952	4,605,268	4,623,726	4,449,750
1953	4,987,792	5,087,385	4,691,986
1954	5,554,236	5,425,227	4,935,764

All the 1954 figures are records and it will be seen that they are each about one million tons over the pre-war figures—an increase of approximately 25 per cent.

Altogether, the scene at Belfast Harbour is one of great activity and progress. The works of development about to be undertaken should enable the increasing trade of the Port to be dealt with as rapidly and as conveniently as possible; prevent delays to shipping and reduce handling costs to a minimum. The expenditure will be heavy but the Commissioners have embarked on these schemes to ensure that the Port's facilities remain adequate to meet the needs of Ulster's expanding trade.

Fixed Navigational Beacons—continued

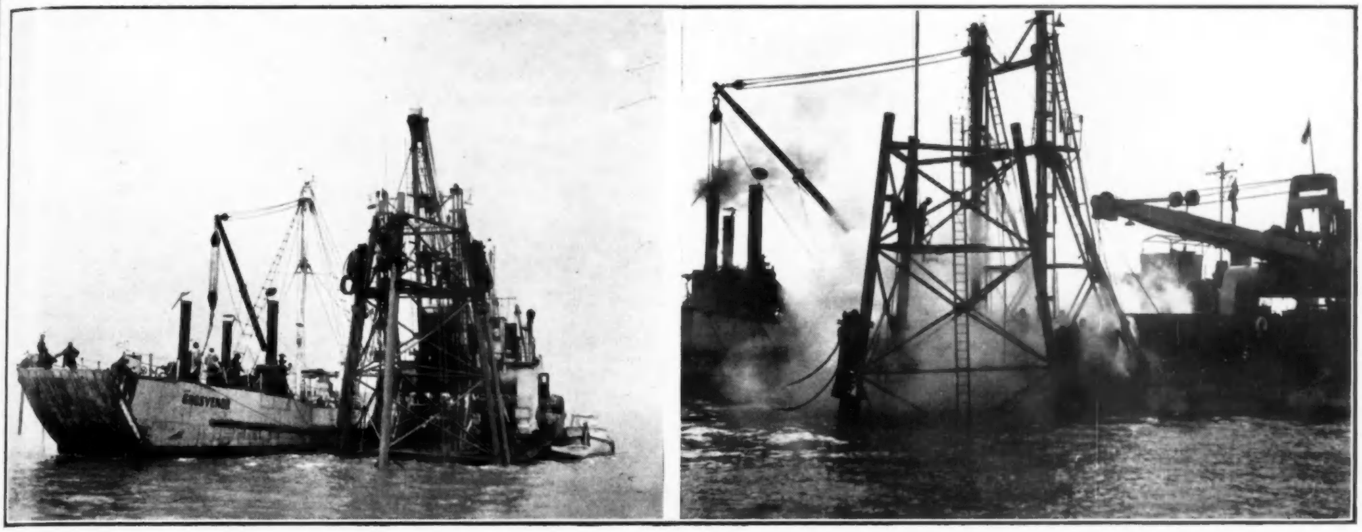


Fig. 2. (Left) Structure in position prior to pile driving. (Right) Pile hammers nearing water.

driving. The frame was lowered onto the sea-bed, the pile-hammers connected to the boilers and simultaneous driving commenced (Fig. 2). No difficulty was experienced in controlling the driving, and the piles were kept moving steadily and the frame remained on an even keel. All three piles drove easily into the sandy bottom and driving was continued with the hammers below water level until the pile guide straps made contact with the sleeves through which the piles passed. To facilitate driving under water compressed air lines had been connected to the hammers to keep the ports clear and exhaust pipes were extended above the surface. As soon as the piles had been driven home the hammers were raised and disconnected from the frame, leaving it fixed to the sea-bed and only needing the attachment of the deck fittings to be complete.

The time taken on the site on this occasion was six hours. Some improvements have been made in the final design by fitting special lifting lugs to speed the release of the frame from the carrying craft and to save valuable site time, but otherwise the design was considered to have been proved by the successful placing of the prototype.

Ten further beacons have been placed during the summer of 1955, these being to the same design with only the slight modifications mentioned. For placing these beacons a single craft was fitted with sheer legs and boilers and carried out the complete operation of transporting, placing, pile-driving, and fixing the deck-fittings. The actual placing and fixing time was reduced to approximately three hours, and relatively more time was spent in getting to and from the sites and laying the lifting moorings.

Further Beacons under Construction.

Four other beacons which are to be placed in deeper water are being constructed in two parts, as the extended frame plus hammers would be beyond the capacity of the craft. Locating pins in the legs will make joining easier, and when the 20-ft. tall prefabricated top section is dropped into place the joints are to be bolted up. The deck fittings include a triangular steel mark, surmounted by a navigational light, a cupboard for gas bottles for the light, and a mast. A davit for handling the gas bottles is attached to one leg of the structure, and a ladder and boat fenders facilitate access.

The structures were fabricated by Messrs. Tubewrights, Ltd., and placed by Messrs. John Mowlem and Co. Ltd., using their pile driving craft "Grosvenor." Cathodic protection of each beacon is being arranged by the Admiralty. Design and supervision of the work was carried out by various members of the Civil Engineer-in-Chief's Department of the Admiralty.

Development of Mozambique Ports

The Administration of the Harbours, Railways and Transport of Mozambique is continuing its programme for the development of the main ports.

Port Amelia deep sea wharf is now under construction at Pemba Bay. It is located in line with the present spur near the port office and Customs building, and will be T-shaped, having arms of different lengths. The cross arm is for berthing and is 120 metres long and 17 metres wide and the other arm, forming the access bridge, is 79 metres long by 12.4 metres wide. In this way the wharf can berth two ships simultaneously, one for deep sea draughting up to nine metres on the main berthing side, and one for coastal service draughting up to five metres on the shore side. This project also includes the reclamation of an area next to the bridge, about 200 metres by 50 metres, which will be duly protected against the sea. The wharf was started in November, 1954, and is expected to be completed by the end of 1956.

Nacala.—A large general construction plan has been approved for this port, which has ample anchorage space, with an entrance 1 km. wide and 60 metres deep, and is a natural shelter for navigation, there being practically no current, no wave effects from the open sea and very little wind agitation. A deep sea wharf is under construction 545 metres long, of which 300 metres are intended for ocean-going ships of up to 10 metres draught and the remainder for coastal craft. In conjunction with this wharf it is proposed to build a dry-dock about 230 metres in length for the use of deep sea ships. These works comprise the first phase of the general plan and will be completed by the end of 1957.

Lourenço Marques. Since 1953, work has been in progress gathering information for a general plan of reconstruction, and to date the following studies have been made: hydrographic surveys of the area of the estuary and bay which are of interest for the lay-out and access of the port; measurement of the fluvial maritime currents; topographical surveys of the coastal zone between the main wharves and Matola; several geo-technic probes to collect test samples for the expansion of the coaling plant, etc.

Beira. Similar investigations to those undertaken at Lourenço Marques have been made, and an identical programme of work is planned duly adapted to the special circumstances of the port. In addition, observation and studies for the extension of the present mineral ore wharf are being made. The widening of wharves 4 and 5 in the direction of the shore by means of a reinforced cement structure of slabs and beams laid on piles of the same material, over a length of 274 metres and a width of 26 metres, was started in October, 1953, and will shortly be completed.

Problems of Increased Temperatures in Harbour Waters

Combined Research Programme at Southampton

By J. P. M. PANNELL, M.B.E., M.I.C.E., M.I.Mech.E.
Engineer to the Southampton Harbour Board.

The great programme of expansion initiated since the war by the British Electricity Authority has included a large number of power stations sited on the margins of docks and harbours. Among the advantages of this arrangement are, the carriage of fuel by sea direct to the station, and the abundant supply of water for cooling.

Unfortunately, cooling water is not returned through the outfall at the normal sea temperature, but is usually some 15 to 25 degrees (Fahrenheit) warmer. The vast quantities poured out at this increased temperature may affect a considerable volume of sea water surrounding the outfall and create conditions favourable to the growth of marine pests, but unfavourable to other forms of fish life.

The new power station at Marchwood, adjoining Southampton Water, has passed through planning and the first stage of construction, and is due to start production early next year, when the first of eight units will be brought into service.

When this station is completed, the amount of cooling water passed through the system and returned to the estuary will be 26 million gallons per hour, raised to a temperature 17 F. above the normal sea.

The Southampton Harbour Board, as the Local Sea Fisheries Sub-Committee, are in that capacity responsible for the well-being of salmon in migration past the power station site to the famous reaches of the River Test. The Board, is the owner and operator of properties including the Town Quay, Royal Pier and a number of navigational aids which include a substantial amount of timber piling; it also has a neighbourly interest in the considerable number of frontagers in the Port who have timber structures below high water mark.

On account of the difficulties experienced in other ports through the raising of sea temperatures affecting fish life or increasing the attack of teredo and gribble, it was decided, at an early stage in the planning of the station, to initiate an investigation into the existing sea conditions. This would provide a basis of comparison for any changes which may be expected to occur through the raising of sea temperature by the operation of the power station.

Fortunately, the scheme met with the keen co-operation of the British (now Central) Electricity Authority and of the University of Southampton.

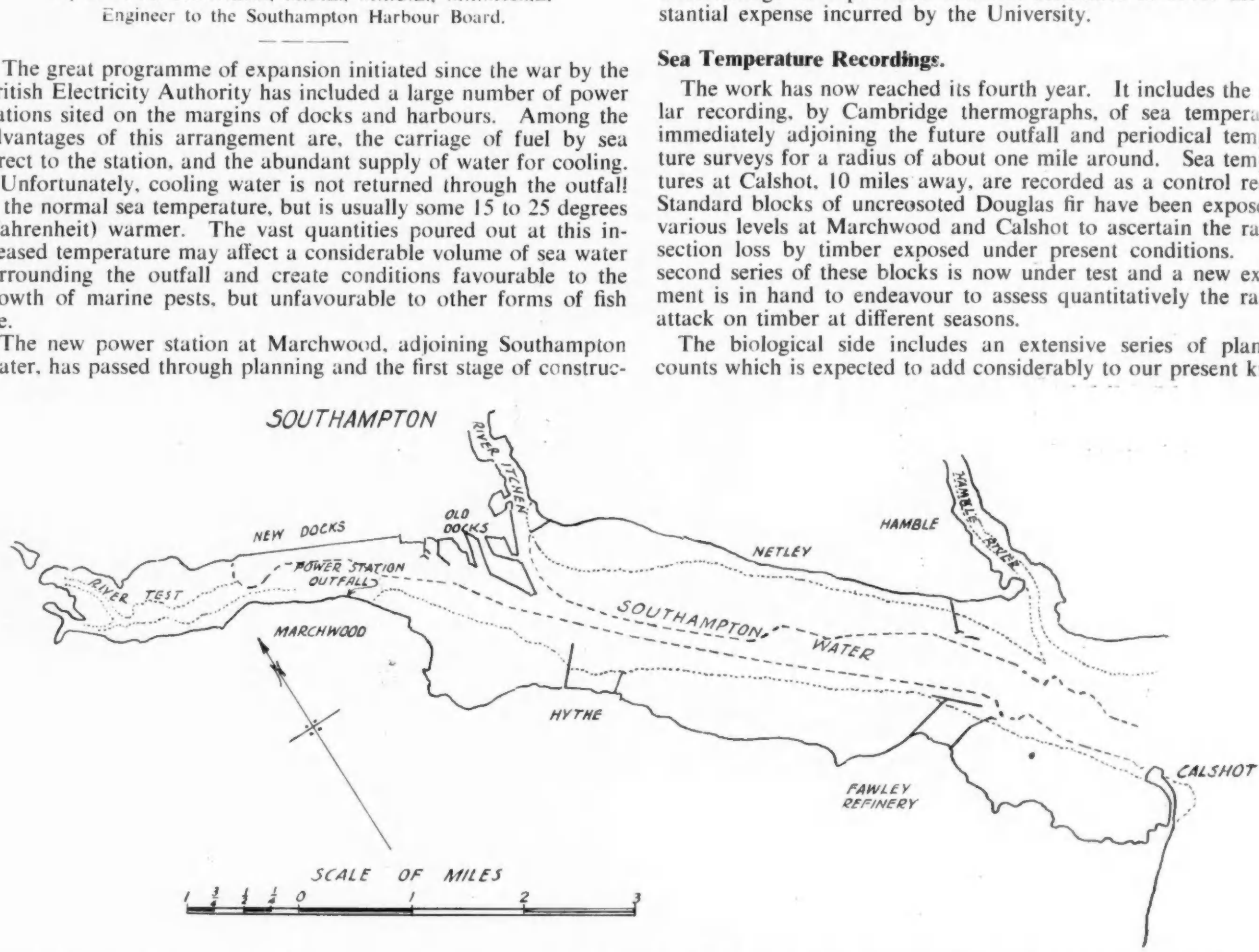
A programme was prepared by a panel representing the three bodies, under the guidance of Professor J. E. G. Raymont of the Department of Zoology, University of Southampton. This panel includes engineers of the Electricity and Harbour Authorities, the chief chemist of the Electricity Authority and the Professor and staff of the University Zoology Department.

In addition to technical services, the Electricity and Harbour undertakings have provided financial assistance to cover the substantial expense incurred by the University.

Sea Temperature Recordings.

The work has now reached its fourth year. It includes the regular recording, by Cambridge thermographs, of sea temperatures immediately adjoining the future outfall and periodical temperature surveys for a radius of about one mile around. Sea temperatures at Calshot, 10 miles away, are recorded as a control record. Standard blocks of uncreosoted Douglas fir have been exposed at various levels at Marchwood and Calshot to ascertain the rate of section loss by timber exposed under present conditions. The second series of these blocks is now under test and a new experiment is in hand to endeavour to assess quantitatively the rate of attack on timber at different seasons.

The biological side includes an extensive series of plankton counts which is expected to add considerably to our present knowledge of the local movement and habits of these small creatures. In addition to its association with harbour problems, this plankton investigation has an important bearing on the choking of water pipes and condenser tubes by mussels or barnacles, a subject of great importance to the Electricity Authority.



The University has also undertaken a detailed study of the life and breeding habits of the gribble (Limnoria lignorum).

River Pollution Investigations.

In addition to the joint investigation by these three bodies, the Southampton Harbour Board has for some years collaborated with the Hampshire Rivers Board in a joint monthly survey of pollution in the Rivers Test and Itchen. A valuable series of records has been built up, which provides information on the chemical condition of these rivers over a period of years and will help to complete the overall picture.

It is intended to continue for some years the joint investigation into the effect of warm water entering the estuary. Probably four or five years study after the station comes on full load, will enable some sound conclusions to be drawn. These will be of great value, not only to the Port of Southampton, but also to electricity and harbour authorities throughout the world. Perhaps other potential opponents, on purely technical matters, will be thus persuaded to combine in a friendly way, to find facts of value to us all.

New Passenger Terminal at Helsinki

Multi-level Development in the South Harbour *

Introduction

HELSINKI (Helsingfors) was founded in 1550 at the mouth of the river Vantaanjoki about 10 kms. north of the present city. The site proved, however, to be unfavourable, especially with regard to harbourage, and in 1640 the town was moved to a cape called Vironniemi. Helsinki became the Finnish capital in 1812. As a port, however, it was of relatively little significance up to about the middle of last century.

After Helsinki had become a capital city in 1812, its harbours underwent a complete transformation. During the years 1812-1825, the central section of South Harbour was given approximately the form it has today.

The construction of Herttoniemi harbour dates in the main from 1931-1938. In the latter year a railway 9 kms. long (belonging to the municipality) was completed from Oulunkyla on the trunk railway.

During the years preceding World War II the Jätkäsaari Quay in West Harbour was extended and new quays built on the opposite side of the basin. In South Harbour, the Katajanokka Quay was extended and the new part of the Passenger Quay built. New warehouses were built in the port and more quay cranes acquired.

The principal imports at Helsinki, in the immediate neighbourhood of which is concentrated 80 per cent. of the total population of Finland, are piece goods, grain and cereal products, coal and coke, oils, fertilizers and metals. These amounted to 1,932,000 tons in 1954. Exports are almost exclusively timber and timber products such as paper board and cardboard, woodpulp, cellulose and sawn timber. The tonnage exported in 1954 was 407,000.

This article is mainly concerned with a conspicuous development in the South Harbour of a new Passenger Terminal and Customs Warehouse (Fig. 2).

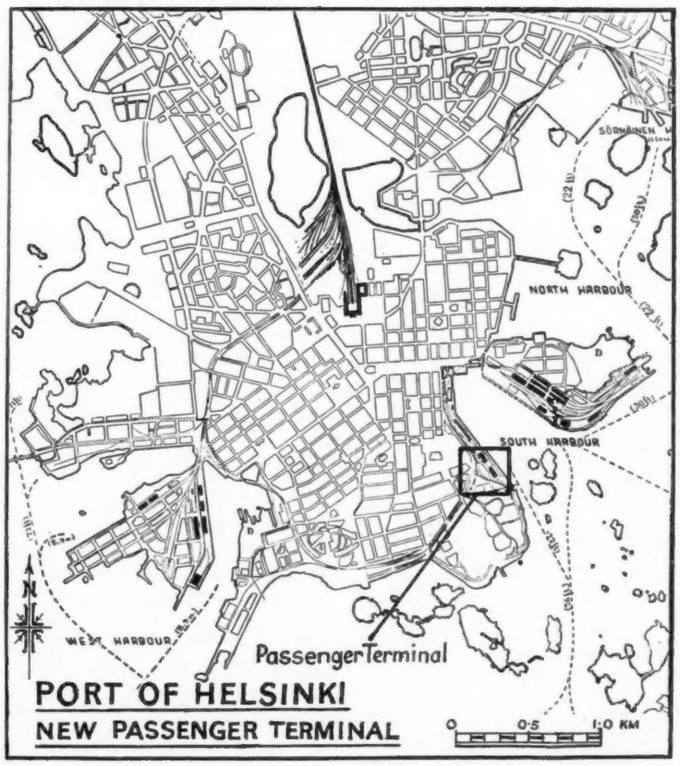


Fig. 1.

*Compiled from material supplied by the Helsinki Harbour Board, and K. W. Hoppu, M.A., former General Manager of the Port.

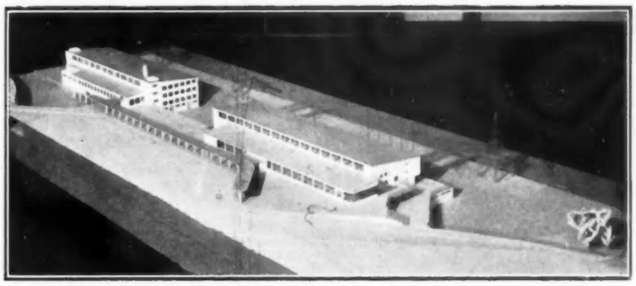


Fig. 2. Model of the Terminal Buildings.

Development of Terminal Area

A few years before the last war the City of Helsinki bought an area of 36,000 sq. metres of land in the south of the South Harbour. This land had for the past 150 years been used for a dockyard, but had recently fallen into disuse. It was decided to incorporate this area into the South Harbour zone, and to build thereon a passenger terminal. A quay was commenced in 1937, 340 metres long, and it had been intended to locate the terminal adjacent to this quay in time for the 1940 Olympic Games. The quay was completed and equipped with two cranes by the time war broke out in 1939.

After the war new plans were developed by S. Randalin, building manager for the Building and Construction Department, and K. W. Hoppu, general manager of the Port, assisted by Eng. Per Duncker. These plans provided for the shore road, Ehrenströmintie, which encircles the so-called diplomatic district of Kaivopuisto, to be continued as a viaduct (capacity 20,000 Kgs. per sq. m.) over the depression of the dock area, and to be joined into the road Etelrantatie, which skirts the South Harbour. In this way a large area would be created which could be used partly as a railway tunnel and partly as a warehouse for long-term storage. The new passenger terminal was to be located on two levels, one connecting with the new road, and the other, 6 metres below, in direct communication with the quay (Fig. 4).

An extension of the Ehrenströmintie road over the roof of the tunnel was to be used as a car park for the passenger terminal.

Sixty metres to the north of the site of the passenger terminal a two-storey warehouse was planned, and both terminal and warehouse were scheduled to be set back 28 metres from the shore line, in order to provide for three railway lines and a motor road on the quay.

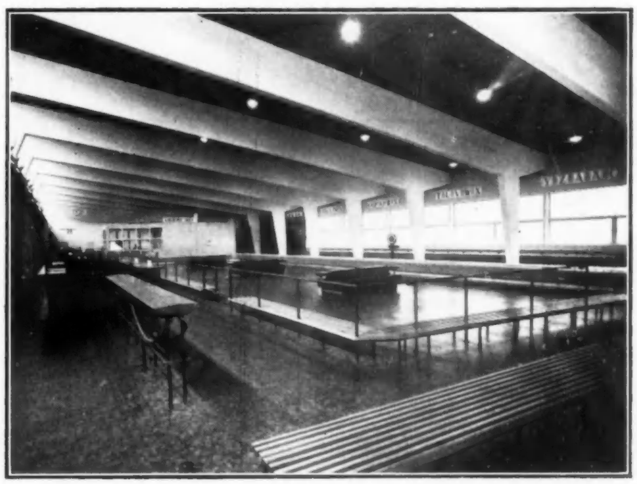


Fig. 3. The Customs Examination Hall.

New Passenger Terminal at Helsinki—continued

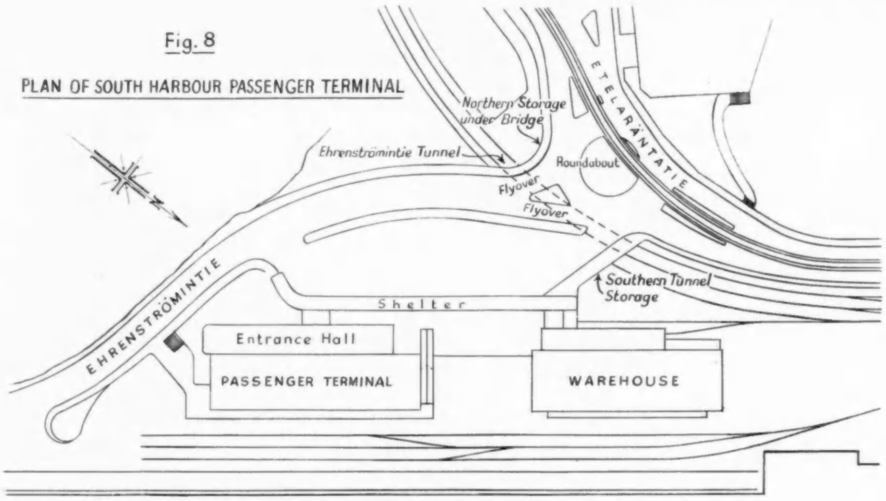


Fig. 4.

These general conditions were made the subject of a competition; the firm of Hytonen and Luukkonen were the successful competitors. The contract for the work was let to A. W. Liljeberg Co., under the supervision of a contractor's committee appointed by the municipal government.

Construction work did not begin until February 1951; it had been planned that the Ehrenströmintie bridge and passenger terminal should be ready in time for the Olympic Games of 1953, and this necessitated working three shifts; sometimes there were as many as 600 men employed. There were difficulties and delays, not least of which were the demands for steel for the war indemnity industry which conflicted with requirements on the site; there were also currency difficulties in respect of imported components such as the aluminium sheeting for the roofs. Fortunately the difficulties became less as time went on, and the work was enabled to proceed at greater speed.

The Passenger Terminal Building.

This building (Fig. 2) which is on two floors, has a total floor area of 4,700 sq. m., and a cubic capacity of 34,300 cu. m. The main passenger hall is located at ground level at the back i.e. the side facing the road, while on the other side facing the quay, it is at first floor level. This hall contains a Customs Examination hall (Fig. 3) of 1,455 sq. metres, a cafe and kitchens, together with accommodation offices for customs officers, search rooms, baggage elevators and other amenities. The walls and ceiling have been treated with noise-absorbent material.

The baggage examination tables are surfaced with aluminium. The floor is Finnish pine parquet and there is a Crittall heating system beneath it, as well as heating elements on the walls. All floors are designed for a load of 3,000 Kg./sq. m.

Communication with ships is by means of glass-enclosed footbridges terminating in staircases which are adjustable according to the height of the ship. There are also passenger elevators to quay level, but their use is discouraged to avoid traffic congestion on the quayside. Luggage is handled by crane direct from ship to a platform at hall level; it can also be taken from the quay level warehouse by truck (Fig. 5).

The New Warehouse.

Sixty-eight metres to the north of the passenger terminal building is a two-storey warehouse (Fig. 6) with a floor space of 7,115 metres below sea level and a volume of 38,010 cubic metres. The building also contains the heating and ventilation systems for the two buildings. There is a single track siding at quay level, at which goods may be handled under cover. Each examination station in the warehouse is connected by pneumatic dispatch tube to the offices on the first floor.

Ehrenströmintie Railway Tunnel

Considerable provision for long-term storage has been made available in the construction of the tunnel, so that the space under the road approach to the terminal may be said to be honeycombed with railway lines and storage spaces. Fig. 4 shows a plan view of this area. The southern tunnel hall has a capacity of 3,985 sq. metres, of which, after deducting space for sidings and heating plant, there is available for storage 3,407 sq. m. Two cool stores, one at 10 deg. C. and one at 6 deg. C. have been provided. Allowance is made for loading both railway wagons and motor vehicles.

Apart from the railway tracks connecting with the Helsinki terminus, there is another large storage space at the north end of the tunnel with a capacity of 9,100 cu. metres, most of which is heated to 18 deg. C. The remaining space unheated, is used for storage of stevedoring equipment.

Provision for Further Extension

The above arrangement of buildings and underground storage has a total volume of 140,000 cu. m. The heating plant already installed has a capacity of 200,000 cu. m., with the intention that a further 60,000 cu. m. of warehouse and accommodation can be added to this part of the South Harbour.

Navigation

Hitherto the entrance to the South Harbour has been narrow in consideration of the increased traffic resulting from the construction of the terminal, it was found necessary to improve the entrance, by blasting a fresh channel through solid rock at 1.5 metres depth down to 8 metres, with a width of 60 metres.

The total cost of the developments described above, which were completed early in 1955, has amounted to £1,850,000; the work was financed from the revenue of the Port Administration.


Fig. 5. Quayside face of Passenger Terminal luggage loading platform, upper centre, public gallery immediately below.

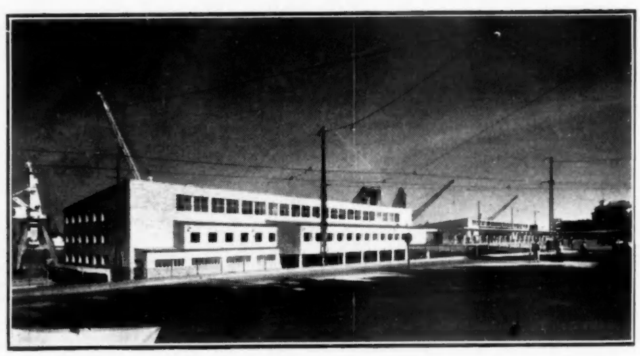


Fig. 6. The Warehouse viewed from Ehrenströmintie. Passenger Terminal to the right.

Timber and the Marine Borer Problem

The Importance of Using Resistant Materials

(Specially Contributed)

The marine borer has long been the cause of extensive damage to piles and other woodwork in the harbours of the world. It is sometimes believed that attack can only occur in sea-water of particular temperature, but this is not so. These pests need only a moderate degree of salinity in the water to find conditions favourable to their development, and while they appear to flourish in warm, tropical climates they can also thrive in cold northerly waters.

Certain marine borers have caused damage around our coasts, and whether this is due to the warm currents of the Gulf Stream or not is of little moment. It is certainly true to say that attack can occur in fresh-water harbours (that might well be thought to be immune) should the water be at all brackish.

The method of attack by the borer is of interest and takes up one of two forms.

The teredo (more popularly known as the ship worm) is hatched out from an egg, and is extremely small at the time of hatching. It is a free swimming organism and in the early stages of its life moves around in search of suitable timber into which to bore, this usually being found very slightly above mud level in the case of piling.

Entrance into the pile is made by boring a hole at right-angles to the grain, but as the ship worm is still very small even a considerable number of entrance holes are not readily noticeable. Once inside the pile the ship worm changes its direction so as to bore parallel to the grain, and then begins to change quickly into more of a true worm-like shape. The holes have to be enlarged to accommodate the growing body of the pest, and it is a characteristic feature of this type of attack that the borer galleries are lined with a shell-like deposit. It will be appreciated that the outward appearance of the pile gives little indication of the true state of affairs within.

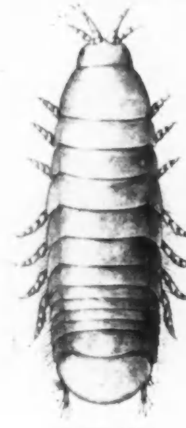
Marine biologists and others recognize several varieties of teredo, and the length and diameter to which these pests can grow will depend partly on variety and partly on the food supply available. Thus if the number of teredo is large they will measure only a few inches in length and be almost thread-like, whereas if the number of pests be small, individual members can grow to a yard or more in length with a body diameter of three-quarters of an inch or more. It is only of academic interest, however, whether the pile is ruined by a few large or several small holes.

An alternative form of attack is made by the *limnoria* or " ship lice," or " gribble." These do not swim as readily as the teredo

TEREDO

WOOD ATTACKED BY TEREDO

WOOD ATTACKED BY GRIBBLE



GRIBBLE

and confine their attack to the outside of the wood. An enormous number of holes is bored into the wood to the depth of not more than half an inch. Under the influence of tides, etc., the weakened wood disintegrates, and fresh areas of uninfested wood are thus exposed to attack. When the latter has become very severe, the pile may have something of the appearance of an old-fashioned hour-glass, and if the attack continues unchecked complete structural collapse may result. The important features of this type of attack is that it can be recognized at a comparatively early stage, allowing remedial measures to be taken.

Various measures can be adopted to limit the activities of marine borers; these include coating of the timber with metal or concrete, poisoning the wood with preservative compounds to render it unattractive or dangerous to the pests, and the use of timbers that have been proved to be strongly resistant to attack.

The first is usually an expensive process and unless a complete protective sheathing can be employed may not be altogether effective. Pure copper is an ideal material for the purposes, but apart from expense, it is too easily damaged. A slight fracture during the driving of securing nails or an unfortunate heavy bump against the pile can result in the exposing of minute areas of wood that are more than sufficient to provide access for the teredo.

Cheaper alloys of copper and zinc are open to the same objection, and of these types of protective coating concrete sheathing is almost certainly the most suitable. Here economic considerations may be of importance, and it may be advisable to replace the timber-sheathed pile by an all concrete member, which removes it from the scope of the present consideration.

In the case of preservative treatments, the fluids used may range from the familiar creosote to various chemical compounds. Of these creosote provides the cheapest and one of the most effective treatments, but surface application by brush or spray is not sufficient. Adequate penetration of the fluid can be ensured only by treatment of the wood by pressure processes. Again, it is essential that any joints or holes necessary in the pile should be cut or drilled before treatment, as subsequent manufacturing processes may expose untreated wood. It is also important to note that even a degree of penetration with certain timbers (such as Douglas fir, which is extremely popular as a timber for piles) can be ensured only by incising the timber. Incising is a process by which the wood is passed through studded rollers that punch a series of holes in its surface at regular intervals.

For most purposes sapwood (*i.e.* that timber which, in the growing tree, was actually engaged in the conduction of sap) is regarded as something of a liability. It is more readily attacked by fungi and insects than is the stronger heartwood, an untreated sapwood will therefore succumb to marine borer damage quite easily. On the other hand, sapwood, being more permeable than heartwood is easily treated with preservative fluids, and with pressure treated wood therefore becomes an asset instead of a liability. For this reason round timber poles are often used in lieu of sawn wood. Such round poles are merely barked logs, and as such have a com-

Timber and the Marine Borer Problem—*continued*

plete sheath of sapwood which is given exceptionally good protection by an impregnation pressure process.

Contrary to general belief no untreated timber is completely immune from marine borer attack, but the standard of resistance varies enormously between species. As might be expected the denser hardwood species are more naturally resistant than are the softwoods, but on economic grounds alone the latter are often chosen for service as their price, after pressure creosoting, compares very favourably with that of the hardwoods.

It will be as well to consider some of the species that have been proved suitable for marine piling. Some of these timbers will be " new " ones inasmuch as they are not well known in this country, but diminishing supplies of certain woods coupled with their high cost have caused harbour engineers to widen the search for suitable timbers. The new timbers described below are those that have gained a good reputation locally, where conditions are usually more severe than in this country: the data on which the timber has been classified as resistant to marine borers has usually been based on an exhaustive series of service tests.

Greenheart (occasionally known as *Demerara greenheart*) is one of the best known of the timbers used for harbour and dock works. It has a long record of service in this country, and was extensively used for work on the Manchester Ship Canal and other important installations.

This wood is a rather greenish colour, often marked with blackish or brown streaks, and is obtainable in good dimensions: the sapwood is wide, fairly well marked off but fading gradually into the heartwood. Unseasoned timber of the species may weigh as much as 80 lb. to the cubic foot, and even in the air-dry state average timbers are too heavy to float. It is almost impossible to treat the wood with preservative fluids, and it is rather difficult to work. During the latter process a very fine sawdust is produced that irritates the nasal passages of susceptible machinists and produces the symptoms of a bad cold: affected personnel can gain adequate protection by the use of a simple cloth respirator or " smog mask."

Their ease of working, good dimensions and ready response to preservative treatments make the softwoods generally popular for harbour works.

Among such timbers may be mentioned *totara* from New Zealand. This is of a reddish-brown colour that is uniform throughout the wood, any sort of figure being lacking. It is only about half the weight of greenheart, works mildly, and is sufficiently strong for uses where compressive strength is of importance. A very closely related timber known as *podo* or *podocarpus* is available from Africa in good quantities, and would appear equally as well suited. Both *totara* and *podo* are available in timbers of good size and length.

Two other species that are available from Africa are *mubura* and *afzelia*.

The former is a reddish-brown or dark reddish-brown wood, weighing something of the order of 45 lb. to the cubic foot. It is rather hard to work, but with the use of tungsten carbide-tipped saws it will cut fairly cleanly: it works rather better in the green than in the seasoned state. Under pressure impregnation treatments the timber behaves moderately well. The wood has not been used to any great extent in this country, but reports from Africa indicate that it has been very successful for use in the form of round poles. The strength properties are exceptionally good.

Afzelia is rather better known as a timber. Again, it is a reddish-brown wood with a well-defined, rather narrow sapwood. It is another of the timbers that are best used in the untreated state, as it is markedly resistant to impregnation by preservative fluids. The wood contains various deposits that assist its durability but may make machining processes difficult, though the working properties, like the density, may vary considerably from sample to sample. This timber is more decorative than the average run of woods used for harbour works, but it is certainly a good piling timber.

Douglas fir previously mentioned is rather too well known to need description as is *pitch pine*. Comparatively speaking the latter is the more difficult of the two timbers to impregnate satisfactorily with preservatives, due to the high resin content. Another softwood species that reaches this country in good quantity and would appear suitable for harbour works is *Parana pine*. The heartwood is brownish in colour but the wood shows prominent bright red streaks, these last being a natural feature and not indicative of decay or other defect the sapwood is much lighter than the heartwood in colour: as with certain other imported softwoods the " figure " that is so characteristic of the northern hemisphere pines and fir is lacking in this wood. The average weight of the timber, when seasoned, is about 35 lb. to the cubic foot. Working, strength and relative properties of this timber are very good, but it may be advisable to incise the wood before preservative treatments. Timbers of good measurement (both in length and side) are readily available.

The Western Australian *jarrah* is a well-known piling timber, and a very closely related species known as *karri* is available; this so closely resembles jarrah as to be almost indistinguishable from it. *Karri*, however, is not a good timber for use where marine borer attack is to be expected, as it has not the natural resistance of jarrah and is almost impossible to treat with preservatives.

This concludes a necessarily brief survey of timber and the marine borer problem. It cannot be pretended that the list of timber species recommended does anything but give some slight indication of the possibilities, and harbour engineers would be well advised to consider, more frequently than they do, the particular merits of some of the newer imported tropical species.

Rapid Tanker Loading

Expanded Facilities at Kuwait Terminal

The following details of performance at Mena-al-Ahmadi were given recently in a paper presented by Mr. J. Dougary to the Institute of Petroleum.

The number of tankers loading at Mena-al-Ahmadi since 1946 when the first shipments were made, rose from 61 vessels to nearly 2,500 last year, a rate which was exceeded during the first three months of 1955. This required a considerable expansion of the terminal berthing facilities.

There were now six loading berths on the oil pier, a further two converted lines for crude oil on the cargo pier and three submarine berths equipped to handle ships when the normal loading berths were congested.

Increasing Activity.

Since 1951 Mr. Dougary stated over 10,000 tankers had loaded at Mena-al-Ahmadi. In June, 1946, the total tonnage of crude oil exported in 1954 was more than 45 mn. tons During the first quarter of 1955, that level was maintained and even passed, with 685 tankers loading 12,6 mn. tons in three months.

The total time at berth, however, had remained fairly constant in the past four years, at between 18 and 19 hours, due to the fact that terminal loading capacity had been stepped up at least to match the increase in ships' sizes. Masters of the larger vessels were prepared to accept the higher loading rates, which might be as much as 4,000 tons per hour where four 8-in. hoses and two jetty loading lines were employed Last September, the tanker " World Concord " achieved an average loading rate of 3,200 tons per hour.

Quick Turn-Round.

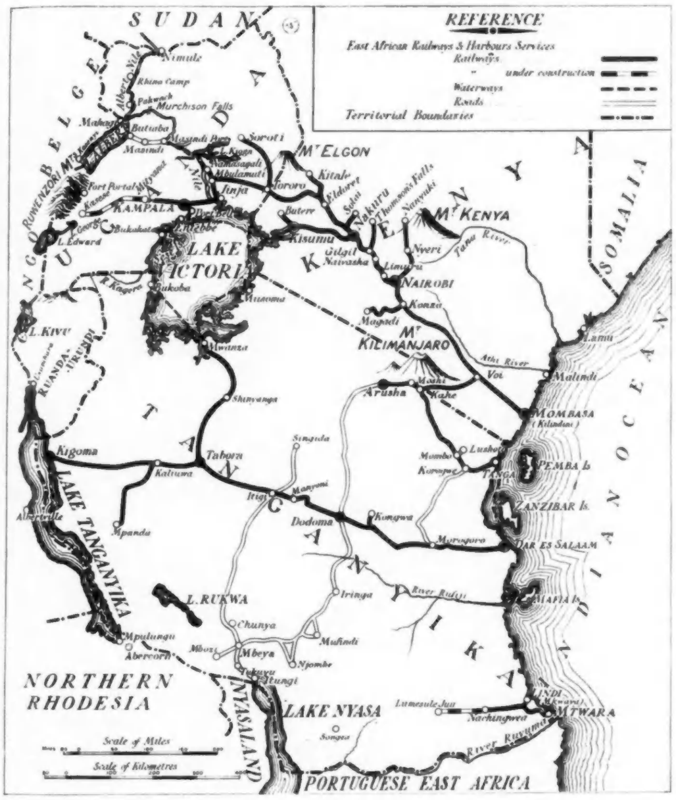
The quick turn-round time of tankers could be gauged from the record of operating performance kept at Mena which showed that in September, 1953, total time in port for 197 vessels averaged only 19 hours 17 minutes, but " bunching " of vessels and unfavourable weather could serve to considerably prolong that figure, and in June, 1952, the average time in port was 38 hours 44 minutes.

In conclusion, Mr. Dougary said that to ensure maximum output at a major crude oil loading terminal with minimum of delays, field production and pumping capacity must at least equal port facilities, or else sufficient tank storage be provided to take up the margin.

The East African Inland Marine Services

An Integrated Lake and Railway System *

WHEN, in December of 1901, the last rail had been laid linking Lake Victoria to the Indian Ocean, the first phase of East Africa's modern transport system was completed. Two years before the railway had arrived at the Lake, a marine survey had been begun by Commander Whitehouse in anticipation of the ships which were to use these waters and which would require accurate charts. This survey was delayed by the illness of the surveyor and was not completed until 1903, when an Admiralty chart was issued.



The Government of the Protectorate of Uganda had the distinction of operating the first power-driven ship upon Lake Victoria when, in 1900, the steam vessel "William Mackinnon" was placed in service between Entebbe and Port Florence. The component parts of this vessel had been laboriously carried by porterage over the greater part of the 577 miles which lay between the Lake and the sea. The completion of the railway facilitated the rapid transport of the parts required to build two more ships—these vessels, the "Sybil" and the "Winifred," together with the "William Mackinnon," which was taken over from the Uganda Government, forming the basis of what is to-day the Marine Services of the East Afrcian Railways and Harbours Administration.

The "Sybil" and the "Winifred" were assembled and eventually launched at Kisumu in 1903 and 1904. The tug "Percy Anderson" was brought from Kilindini at about the same time together with six lighters which had been engaged in off-loading railway stores at Kilindini. The advent of the "Clement Hill" and "Nyanza" in 1907 were welcome additions to the Lake Marine Services which continued to make steady progress.

In 1914 came the first World War and the Royal Navy took over most of the Lake Marine ships to prosecute the campaign against the Germans, who controlled Tanganyika. During these operations the "Sybil" ran aground in enemy waters in November, 1914, and was severely damaged as she lay by enemy gunfire. The cost of repairing her, when she was eventually salved some seven months later, is noted as the large sum for those days of £14,000.

Before 1914 the boilers of the vessels were fired with wood but the incidence of sickness among the woodcutters became so high, due to the depredations of the tsetse fly, that alternative methods of firing had to be considered and, in 1914, the Lake Victoria fleet was converted to burn oil. The years 1914-1915 saw other innovations, notably the addition of the "Usoga," "Rusinga" and "Kavirondo" to the fleet and the adoption of navigation lights to permit night running.

Lake Victoria, by virtue of its great size and geographical significance—each of the three territories of East Africa meet in these waters—is, without doubt, the best known of the Great Lakes. The Lake Marine Services, however, have other commitments, including Lake Kioga, Lake Albert and the River Nile and Lake Tanganyika.

The Lake Kioga marine service was started by the Uganda Government in connection with a railway—the Busoga Railway—built between Jinja and Namasagali when the Uganda Railway was in the final stages of construction. The fleet consisted of the s.w. "Speke," s.w. "Stanley" and a number of lighters. In the early 1920's, at the request of the Government, the Uganda Railway took over Marine operation on Lake Kioga.

At about the same time, in 1924, the Railway also took over the marine services of Lake Albert and the River Nile—the floating assets being limited to the venerable paddle steamer the "Samuel Baker" and the steam launch "Livingstone."

It has been necessary to touch upon railway development in order to demonstrate the sequence of events culminating in the formation of the Lake Marine Services so far as Kenya and Uganda were concerned. The same pattern has been followed in the development of marine transportation on East Africa's second largest lake.

In Tanganyika, the German equivalent of the Uganda Railway was what is known as the Central Line—a railway running for 780 miles from the coast, at Dar es Salaam, to Kigoma on Lake Tanganyika. In conjunction with this railway a twin-screw steamer—the "Goetzen"—was operated on the lake, but the career, under German management, of this vessel was of short duration for, in 1916, she was scuttled. This followed the realization that the British exercised a firm control of the lake, largely due to the activites of small, high speed, armed British launches which had been brought overland to the south end of the lake which lies within Northern Rhodesia. After the war the British took over the

Kisumu Port, Lake Victoria.

*Reprinted from the "East African Railways and Harbours Magazine," June 1955.

East African Inland Marine Services—continued

S.S. "Robert Coryndon" at Butiaba, Lake Albert.

administration of Tanganyika and eventually salved the "Goetzen," which became a unit of the former Tanganyika Railways and Port Services in 1926, being renamed the "Liemba."

The most important function of the Inland Marine Services is to provide a link in a continuous chain of communications between industrial or agricultural sources and potential markets and also between other transport routes. Of all means of communication, that by water is, without doubt, the most economical. Initial costs are confined to the mobile units themselves and to their reception points. There is no permanent way to maintain or roads to resurface. Prominent examples are the lake route between Kisumu and Mwanza, the link with the Sudan Railways using Lakes Kioga and Albert, the route between Kigoma and the Congo routes from Albertville and between Kigoma and the road system from Mpulungu in Northern Rhodesia giving access to the copper belt.

Although the operating routes are naturally provided, the cost of the mobile units is rather high. The initial costs incurred in building the s.s. "Nyanza" (£26,500), the s.s. "Usoga" (£30,291) and s.s. "Stanley" (£29,486) can be considered reasonable by comparison with present-day replacement charges which can be assessed by multiplying the above figures by 10. Again, these high figures can be advantageously regarded when reviewed against the cost of providing a "rigid" transport system such as the Uganda Railway, which was constructed at the rate of over £9,000 per mile.

An interesting facet of the Marine Services organization is the co-relation between the vessels and the waters upon which they operate. Other than small craft, it is not possible to standardize on one particular type of ship for use on each and every lake owing to the individual characteristics of each sheet of water. Lake Victoria is virtually an inland sea and its vastness can be conducive to sea-going conditions, including storms which call for a vessel of sound seaworthy type. On the other hand, Lake Kioga is a system of shallow, placid reaches of water feeding into the channel of the Nile itself, conditions which call for light-draughted vessels, but which need not be of such solid construction. Lake Albert, although much smaller than Lake Victoria, is also subject to storms, often sudden and violent whilst Lake Tanganyika, the longest lake in the world, is narrow and mountain-hemmed and is often whipped by tropical storms raising waves reminiscent of sea conditions. Navigation of the Nile, from the northern end of Lake Albert to Nimule in the Sudan is often hampered by banks of "sudd" formed, by the breaking away from the banks, of large clumps of papyrus grass which gradually build up into formidable obstructions. The peculiarities and idiosyncrasies of these various waterways call for a variety of vessels to meet each individual requirement.

The "Rusinga" and "Usoga" are admirably suited for the Lake Victoria trade and are, of necessity, of stout seaworthy construction. On Lake Albert the impressive "Robert Coryndon" operates and is generally considered to hold pride of place in the Marine Services fleet. Reference has been made earlier to the "Von Goetzen"—renamed, after her raising, to the "Liemba."

To operate successfully a fleet of vessels in a variety of conditions, often arduous, it is essential that adequate maintenance facilities be available and, as each stretch of water is landlocked, the necessity arises for each like to have its own maintenance and operational base. In this respect Kisumu serves Lake Victoria, Namasagali-Lake Kioga, Butiaba-Lake Albert and the Nile, and Kigoma is the depot for Lake Tanganyika. These district marine bases are controlled by the Chief Operating Superintendent through the Senior Marine Officer. At each marine district there is a well equipped workshop, supervised by a qualified engineer, working under the Senior Marine Engineer, and either a slipway, dry dock or, in some cases, both.

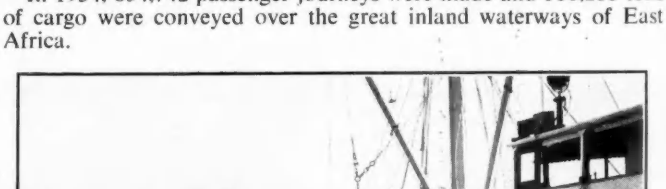
The construction, in the United Kingdom, of a vessel with subsequent dismantling for convenience of transporting, the carriage by sea and rail and the final reassembly before going into service, is a costly business both in time and expenditure, and, rather than procure vessels by the methods mentioned, it has been found expedient and practical to carry out conversions on some of the older hulls to meet modern conditions. The high standard of marine maintenance is reflected in the age of some of the ships still in service, typical examples being the "Percy Anderson" (58 years), the "Sybil" (51), the "Nyanza" (48), the "Speke" (45) and the "Livingstone" (33). It is a fact, however, that the hulls of these inland water ships are not subject in the same degree to corrosive influences as is apparent on the coast. At the time of writing the "Sybil" is a lighter but is scheduled for conversion into a passenger/cargo vessel when, once again, she will traverse Lake Victoria under her own power. The "Percy Anderson" and the "Livingstone" are now smart little diesel propelled vessels.

The marine flotilla, in 1910, consisted of 4 steamers, 1 tug and 6 lighters. To-day there are 10 "capital" ships, 8 tugs, 82 lighters, 17 launches and motor-boats, 1 vehicular ferry and 1 suction dredger—a total of 119 units.

Earnings, in 1910, were £29,000, which has risen, by 1954, to £556,000. The bulk of this revenue was in respect of freight traffic, passenger receipts accounting for only 18 per cent. of the whole. Expenditure, in 1954, was £377,000 which, after allowing for a contribution to the renewals fund of nearly £82,000, left a favourable balance of more than £97,000.

If it were possible to have each unit of the Marine fleet in service at the same time, each vessel being loaded to its maximum capacity in passengers and goods, there would be a total of 2,378 persons plus 10,293 tons of various commodities afloat over 6,311 route-miles.

In 1954, 634,742 passenger journeys were made and 306,200 tons of cargo were conveyed over the great inland waterways of East Africa.



Loading cotton, Mwanga, Lake Victoria.

East African Inland Marine Services—continued

The task of operating and maintaining the Lake Marine Services is entrusted to 1,465 members of the Administration's staff—the racial make-up being, 43 Europeans, 100 Asians and 1,322 Africans—of this number, 941 are employed afloat with 524 in the workshops and offices ashore.

A high standard of officer is insisted upon in order that their skill and experience may be passed on to the junior staff who serve under them. In recent years the African personnel have made a marked advance in ability and skill and the ranks of Petty Officer and Artisan are being increasingly filled from local sources.

In considering future development of the Marine Services, recent events provide a significant pointer. Owing to the increasingly high costs of obtaining new craft of all types from the United Kingdom, the possibilities of construction at Kisumu from basic materials are being explored. The overall cost of a lighter, supplied by British makers, is in the region of £22,000 with a delivery period in excess of two years. The building of a new slipway at Kisumu and the increasing of workshop facilities have already made possible the construction of three lighters and two more craft are at present building in the yard. The cost of a locally manufactured lighter is about one-half that of one made in the United Kingdom with the advantage that work can be undertaken at short notice in accordance with requirements at the time and not the estimated needs of a distant future. Plans are in hand to provide a variety of new vessels including a mobile cattle carrier, a vehicular ferry, a large passenger launch and four new lighters. Other building plans are under construction.

The building of these craft will bring increasing experience adding to the developing skill of the builders. The future of East Africa depends upon the self reliance of its peoples and the initiative of its industries and, in these two essential elements, the Lake Marine Services of the Administration have not been lacking.

Kisumu, Port Workshops.

The Marine Services of this Administration provide for a variety of trips which are available to the public. Each has its own particular interest and all of them are enjoyable. Whichever trip is undertaken a high standard of cleanliness, service and consideration for the comfort of the passenger will be found, for that is the tradition of the Marine.

Minor Port Development Schemes in India

(From our India Correspondent)

A complete blue print of India's plans to develop several minor ports in that country's vast coastline will be ready late in January. A total expenditure of about £4 million is involved. The projects which will form part of the country's Second Five-year Plan envisage improvement of landing and port facilities at about 300 points. An official of the Indian Ministry of Transport is examining the several projects submitted by the State Governments and he has so far approved the schemes for the development of the ports in Madras, Pondicherry, Travancore-Cochin and Kutch. The schemes submitted by the Governments of Andhra, Bombay, Saurashtra and Orissa are now being scrutinised.

According to the present indications, while Tuticorin and Mangalore in the south and Pardip in Orissa on the east coast will be developed as genuine deep-sea harbours, in other ports landing and wharfage facilities will be improved and navigational aids provided. So far schemes costing about Rs. 45 for Madras, Rs. 15 lakhs for Pondicherry, Rs. 25 lakhs for Andhra and Rs. 27 lakhs for Travancore-Cochin have been finally recommended and forwarded to the Planning Commission. Models of a deep-sea harbour for Mangalore are being tested at present at the Kadakvasala research station near Poona.

More important schemes of development include a new pier at Pondicherry, where the port was destroyed by the 1952 cyclone, improved ore handling facilities at Cocanada, construction of a new pier at Quilon in Travancore-Cochin and training works to improve the bars at the mouths of the ports at Cuddalore and Nagapatam. River-training works in Bilimora at the southern end of Gujerat, landing facilities at Versova and Dahanu in Bombay and an approach gangway at Surat are being planned.

Cocanada in Andhra exports large quantities of ore to Japan and other countries, and last year the port handled about 200,000 tons of ore. The development scheme for Cocanada port includes partial mechanisations of cargo handling and provision of four new jetties. When the scheme is completed the port will handle twice as much cargo as at present. The pier at Quilon is expected to cost Rs. 25 lakhs.

The development plans also envisage the dredging of some of the smaller ports. A dredging committee, which is representative of all maritime States, will sit in February to complete these plans and the State Governments will purchase dredgers for this purpose.

Bombay Dock Gates Under Repair

After more than 15 years, the outer lock-gates of Alexandra Dock—Bombay's only round the clock dock—have now been dry-docked for repair. These gates, each weighing 300 tons, have been removed to Huges Dry Dock, about a hundred yards from the entrance to the dock. Their removal may slightly affect traffic in the dock owing to the smaller quantity of water in the area between the inner and outer gates, but does not convert the dock from an all-weather one to a tidal dock.

The repairs proposed are expected to cost around £40,000 and to take between four and five months. Tons of barnacles will have to be removed from the sides of the gates, wooden planks and steel plates replaced, corrosive effect in the frame-work nullified and gates painted and treated with anti-corrosive within the four or five months period.

Expansion at Gothenburg

During a recent visit to Great Britain, Mr. Stig Axelson, harbour director of Gothenberg, stated that as a result of ever increasing activity in that port, considerable extensions were planned. The biggest single increase in imports is in crude oil. To cope with this, a second refinery is being built near the port, and a new oil jetty of the "finger pier" type is to be built. It will have a depth of water of about 40-ft., and will be able to accommodate the new super-tankers on either side of the pier up to a maximum length of about 700-ft.

Simultaneously, the harbour entrance is to be deepened by approximately 6-ft., and it is expected that the whole of the work will be completed by December next. Gothenburg at present handles about 1,200,000 tons of crude oil, or about one-third of Sweden's total oil consumption. When the new installations are completed this figure is expected to reach about 2½ million tons. A new passenger terminal is also being built.

The Measurement of Littoral Drift by Radio-Isotopes

Field Experiments to aid design of new Japanese Port*

Introduction.

SINCE the Second World War, the Japanese Government has assisted in the general development of Hokkaido as part of the multiple development plan in Japan. It is hoped to ease the problem of over-population while at the same time furthering the economic independence of Hokkaido. An industrial port is to be constructed at Tomakomai City in the southern part of the Yufutsu Plain in order to assist the city's industry and export trade. The hinterland is rich in natural resources; (for instance the Ishikari coalfield) and there is a plentiful supply of water for industrial and domestic use and enough flat land for factories and houses.

Fig. 1 is an illustration of the model of Tomakomai Industrial Harbour, which is to be an excavated harbour. The length of the east and west breakwaters will be 970 and 800 metres respectively and the draught depth will be 9 metres to take ships of up to 10,000 gross tons. The industrial port is to cover an area of 1,900 hectares, the commercial port an area of 120 hectares. It is estimated that the residential district will occupy an area of 4,500 hectares with a population of about 1,000,000.

The authors have been engaged on the plans of Tomakomai Industrial Harbour since 1951, and as it is to be situated on a monotonous sandy beach approximately 120 miles long they have had difficulty in evolving the cheapest method of protecting the new harbour from littoral drift. Unfortunately, no general method has yet been found for analysing the phenomena of littoral drift; the authors have therefore made use of radio-isotope glass sand to study the movement of the seabed.

Experimental Method.

If it is possible radioactively to label the sand at a given point on the seabed, it is also possible to observe the movement of that sand as a result of littoral drift. Ground glass containing a substance called Zinc-65, a radio-isotope, was chosen for the labelled sand. This was placed on the seabed, and by making use of a radiation measuring instrument, its movements were traced to find out how far and how quickly sand was dispersed by waves or littoral current.

The radio-isotope used for such a purpose must satisfy the following conditions:

(1) It should be an emitter of gamma-rays.

(2) The energy of gamma-rays should be high enough to have a good range in sea water.

(3) The flux density of gamma-rays should be high enough to give good detectability.

(4) Its half life should be optimum for this experiment, with due consideration of radiation hazards.

(5) It should be such an element as to be easily and strongly fixed as a chemical component in glass.

(6) It should be as cheap as possible.

There were three possible radio-isotopes, those of Cobalt, Silver and Zinc, each of which fulfilled some of the above conditions. However, it was finally decided to use the Zinc isotope, Zn-65.

It is realised that a better isotope for incorporation in glass sand would have been Scandium-46, which would have emitted high energy rays, and at the same time would have a short half-life. Such a material can be prepared only where neutron irradiation, by means of an atomic reactor, is available. In the absence, however, of such a reactor in Japan, the idea had to be abandoned.

In view of the radiation hazards involved it should be pointed out that the material and method adopted provided the following safeguards:

(1) The radio-isotope Zn-65, once chemically fixed in glass, is insoluble in sea water.

(2) When the radioactivity of a grain of glass sand is made less than about 0.1 microcuries, the radioactivity on the seabed should diminish in proportion to the dispersion of the glass sand and decay of the radioactivity.

(3) Even if fish and shell-fish ingested several grains of glass sand, the particles would be weakly radioactive and would be excreted without dissolving in the digestive organs. Therefore it seems that there is no danger of injury to marine organisms or to those who might eat them.

Preparation of Radioactive Glass Sand.

The radioactive glass sand to be used as a tracer must bear a close resemblance in specific gravity and sand-size distribution to the bed materials at the observation point. It also must have sufficient specific radioactivity to be measured, even after it has dispersed over an area of several hundred square metres.

After preliminary examination of the existing littoral sand, the following specification for glass sand was drawn up.

Specific gravity from 2.6 to 2.7.

Sand size and its distribution

Purpose	Range of distribution	Mean
For beach line	0.11—0.55 mm.	0.246 mm.
For 3m in water depth	0.09—0.30 mm.	0.186 mm.

* Compiled from material supplied by Shizuo Inose and Naofumi Shiraishi, Harbour Construction Section, National Hokkaido Development Bureau, Japan.

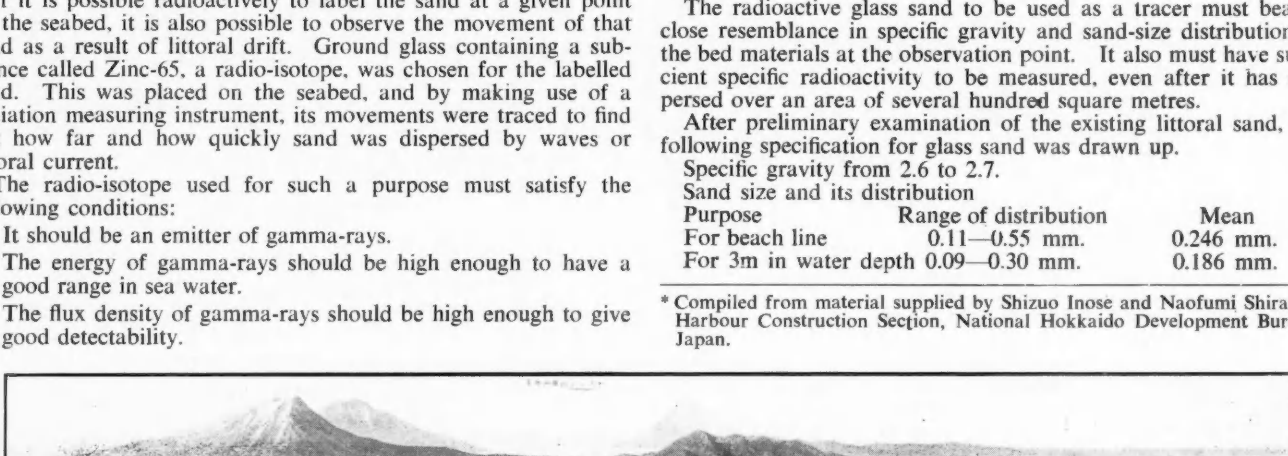


Fig. 1. Model of Tomakomai Industrial Harbour.

The Measurement of Littoral Drift by Radio-Isotopes—continued

Amount required: About 1.5 litres in apparent volume for each experiment.

In addition to the above, the glass sand should be homogeneous in chemical composition and radioactivity and be free from bubbles.

As regards specific activity there are two factors which define the limits of tracer experiments. One of these is the statistics of the nuclear phenomenon and of instrumentation which place a limit upon the reliability of instrument response. The other is the actual yield factor which relates the amount of instrument response to the disintegration rate in the sample.

In calculating the amount of radio-isotope to be added to a given volume of glass, it is necessary to take into account the final activity which will be displayed by a single grain, containing its due fraction of the isotope. It must also be ensured that that activity falls within the limits of the measuring instruments whatever the grain size. Further, provision must be made for reduced efficiency of the detector under field conditions, on account of the mounting of the apparatus, dispersion of rays by sea water and so on. Finally, due allowance must be made for the diminishing activity of the isotope during the process of compounding the glass sand, and during the field experiments. As an instance of the latter, Zinc-65 ordered from America had originally an activity of 100 m.c. By the time the finished material was prepared the activity had dropped to 70 mc., and a further drop to 60 mc. was experienced by the time the field experiments were begun.

Glass normally consists of Silicon Oxide, Sodium Oxide, and Calcium Oxide and its specific gravity is 2.4—2.5. In order to produce radioactive glass sand it is necessary to introduce the Zinc-65 in substitution for some of the Calcium; at the same time the specific gravity is increased by the addition of Lead Oxide.

After some experiments in compounding the ingredients in which ordinary zinc was used, it was found that the best way of introducing the isotoype was in the form of Zinc-65 Chloride in an aqueous solution. This was stirred into the other ingredients until a porridge-like material resulted, which solidified after standing for a day. The whole was then gradually heated to a high temperature in an oxidising atmosphere, when the Zinc Chloride was converted into Zinc Oxide, which then took its place among the fused ingredients of the final glass. After all bubbles had escaped from the molten material the glass was not allowed to solidify in the usual way, but was poured into a quenching water bath, so that it was pulverised. The pulverised material was then crushed and ground through sieves until sufficient glass sand of the desired grading was produced. The final product had a specific gravity of 2.62. The radioactivity of the product was found to vary on random sampling by plus or minus 7 per cent. The finished material was stored prior to use in a polythene bag, which was in turn placed inside a leaden box, of wall thickness of 3 mm., and stored in a concrete compartment The contents of the box were, despite the lead lining, too radioactive to be handled without the precaution of protective clothing for the operators, such clothing being designed to prevent inhalation of glass particles and contamination of the skin by the same.

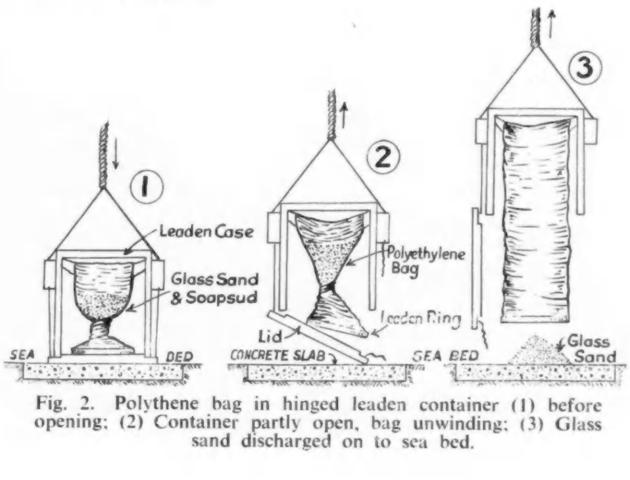


Fig. 2. Polythene bag in hinged leaden container (1) before opening; (2) Container partly open, bag unwinding; (3) Glass sand discharged on to sea bed.

When required for use, the glass sand in its polythene bag was transferred into a leaden cylinder for transportation to the site by boat, and for lowering to the sea bed (Fig. 2). The dimensions of the cylinder were: inside diameter 15 cm., length 15 cm., and wall thickness 3 mm. The top of the cylinder was permanently closed and the bottom was arranged to drop open, upon a wire fastening being severed. The top of the polythene bag was fitted with a leaden ring. The glass sand was treated with an emulsion of soapsuds to ensure rapid wetting of the individual particles as soon as the contents were released into the sea, and also to prevent the grains from floating away on account of adherent air bubbles. The leaden ring was twisted round several times to seal the contents of the bag, before being placed in the cylinder. For additional safety the cylinder was packed in a sand box.

On arrival at the site, the cylinder was lowered to the sea bed and, with a diver in attendance, it was placed with the hinged lid in contact with the sea bottom. The wire securing the lid was then cut and the cylinder raised clear of the sea bed and jigged up and down a few times to encourage the leaden ring to unwind and so allow the glass sand to drop out of the polythene bag.

Fig. 3. Geiger-Muller probe mounted in steel frame.

Field Observations.

Having deposited the glass sand on a chosen spot, the next objective was to plot the drift of the sand due to waves and littoral currents. This was done by measuring radioactivity at the sea bed by means of instruments carried in an open boat. At first a scintillation counter was used. The scintillation head was mounted in a steel tube which was suspended from a boat so that it stood vertically on the sea bed. The bottom of the tube was fitted with a flange to prevent it from sinking into the sand. This method proved unduly difficult, since it was hard to control the boat sufficiently to ensure that the scintillation head was kept steady on the bottom

An alternative method was devised in which the probe of a Geiger-Muller counter was installed in a watertight stainless steel tube and fixed into a frame, which enabled the probe to lie steady on the bottom (Fig. 3). A line and bamboo pole were attached to mark the exact position of the probe. The probe was connected to the G-M counter in the boat by a cable 10 metres in length.

The Experimental Site.

The industrial harbour of Tomakomai is to be sited at the point of intersection of two bow-shaped coasts on Hokkaido. One side extends 60 km. WSW to Cape Chikyu, and the other 120 km. SE to Cape Erimo. The general location and fetch is shown in Fig. 4.

The sea bed material is fine sand, with a specific gravity of 2.6—2.8. The sea bed contours are nearly parallel with the coast line; sand bars are found about 150 metres offshore.

The change in rate of the mean sand-size with the water depth in the direction of the perpendicular to the beach line is shown in Fig. 5. The mean sand size is approximately 0.13 mm. offshore of the sand ridge, and it becomes larger near the crest of the ridge and is approximately 0.22 mm. at the trough. It increases abruptly with the approach to the beach line.

Onshore winds predominate from June to September; offshore winds are relatively frequent in winter. Winds from East and West, parallel to the coastline, are weak throughout the year. The longshore component of winds throughout the year is westward in sum-

The Measurement of Littoral Drift by Radio-Isotopes—continued

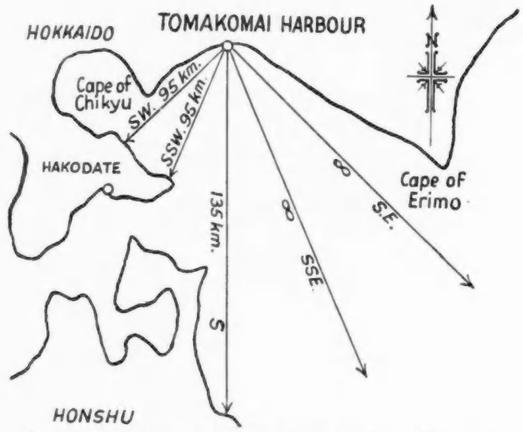


Fig. 4. Tomakomai Harbour, the fetch in different directions.

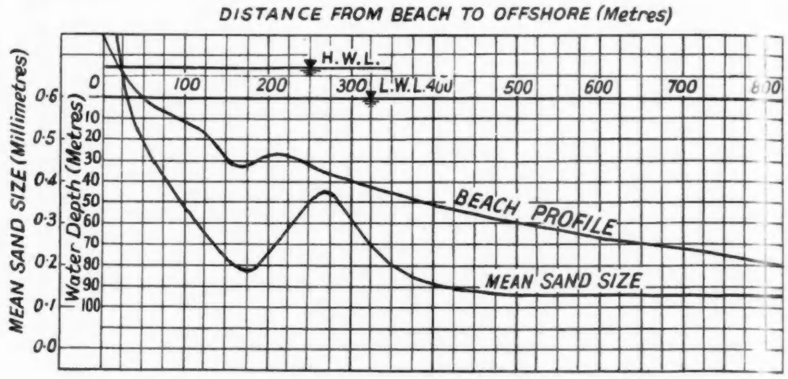


Fig. 5. The relationship between beach profile and mean sand size.

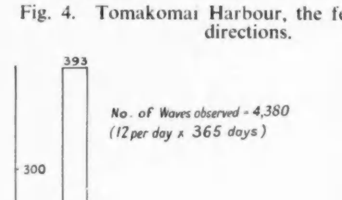


Fig. 6. Estimated wave height frequencies, 1954.

mer and eastward in winter, with the westward component predominating.

Waves from SE through S to SSW are always prominent. In summer, waves from these quarters are frequent; their maximum height in deep water is estimated to be approximately 7 metres. In winter the sea is rather calm, but waves from SW are frequent with a maximum estimated height of 4 metres.

Experimental Results.

Apart from two experiments which will be described in greater detail, the following tests were carried out or are still in progress.

July, 31, 1954: For investigating the movement of sand in the breaker zone, about 1 litre of glass sand containing 30 millicuries was put on the beach line. The movement was, however, too quick to be traced. The sand moved in a zig zag course about 8 metres in 30 minutes, parallel to the coast, and then disappeared, presumably offshore.

July 2, 1955: To determine the movement of sand into a fishing port which is now being constructed, about 0.1 litres of glass sand were placed on both sides of the entrance. This experiment is now proceeding.

August 1, 1955: For finding the depth at which there is no littoral drift induced by waves, glass sand was put on the sea bottom in 9 metres. This sand is moving slowly parallel to the coast, but the results are not yet complete.

It was desirable to relate sand movement observations to the probable incidence of waves over a twelve month period, since waves appear to be mainly responsible for littoral drift. This was achieved by combining the observations from two bottom pressure recorders[9] (located in 9 metres off the Tomakomai Breakwater) with hindcasting techniques[1, 2]. The estimated wave heights are shown in Fig. 6.

June 28, 1954: Fig. 7a shows the dispersion of radioactive glass sand in the first main experiment. A summary of the wave and wind characteristics for the same period is given in Fig. 7b. The contour lines indicate zones in which equal numbers of radioactive impulses were received. The resulting diagram thus gives the dispersal of active sand round the point of application which was at the intersection of the compass lines. Allowance has been made for the inherent radioactivity of the sea and sea bed, and for other random impulses received by the apparatus, which in this case amounted to 15 counts per minute.

The sand movements show a tendency of accretion shorewards up to July 24, and a reverse tendency of erosion by the time of the observation on August 11. These movements appear to be related to the wave steepness, which was, on the average, greater in the latter period.

An experiment to determine the depth at which the littoral drift is minimal, was commenced on May 20, 1955, and lasted until June

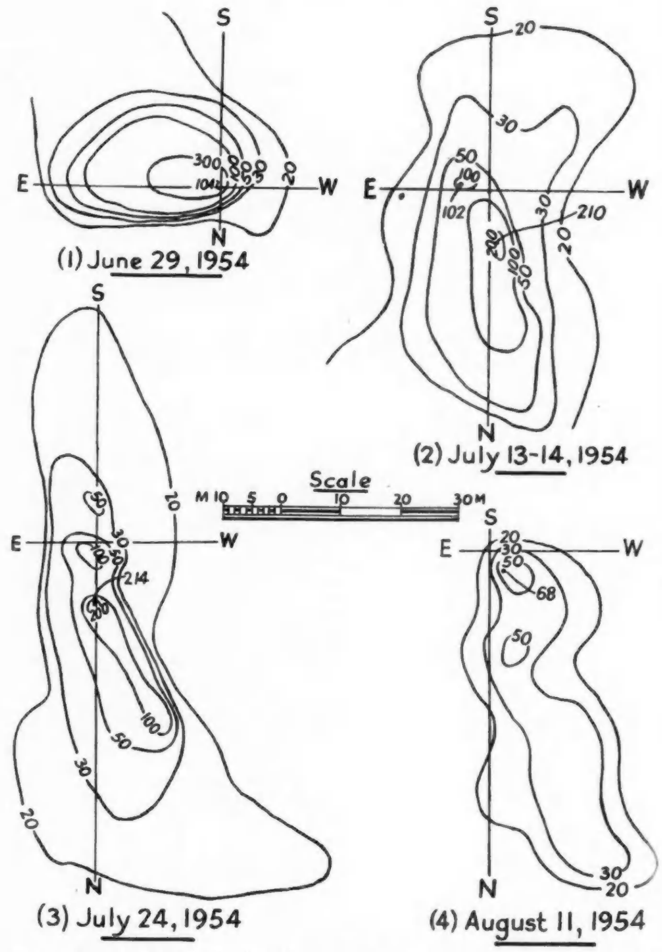


Fig. 7. (a) Dispersal of radioactive glass sand, June 28—August 11, 1954 (depth 2.8 metres).

The Measurement of Littoral Drift by Radio-Isotopes—*continued*

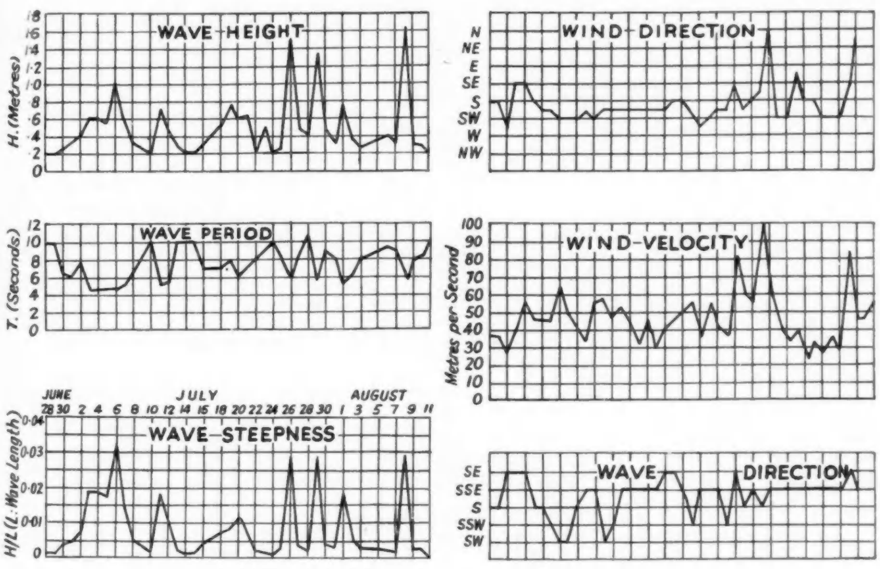


Fig. 7. (b) Wave and wind data, June 28—August 11, 1954.

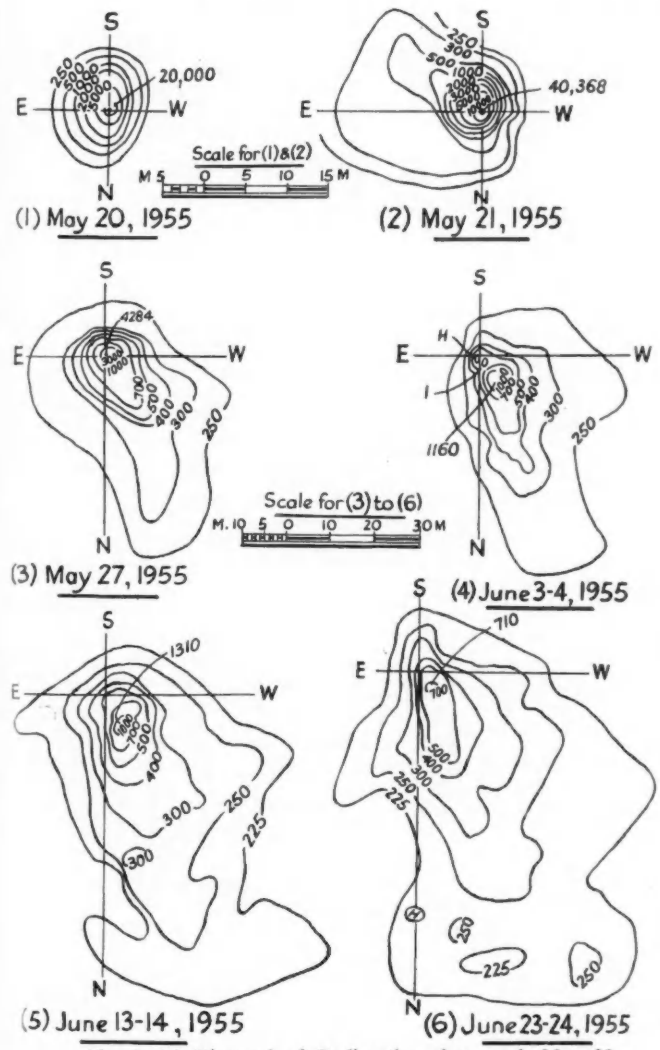


Fig. 8, (a) Dispersal of Radioactive glass sand, May 20—June 24, 1955 (depth 6 metres).

24. According to Fig. 5, the mean sand size in over 5 metres is approximately constant, and there is very little variation throughout the year. It is accordingly presumed that bed movement in 5 metres and over is almost non-existent. The experiment illustrated in Fig. 8a was carried out to confirm this hypothesis. A special geiger counter was made and the mean background of radiation was determined at 220 counts per minute. By reference to Fig. 8b it is seen that some smaller grains of sand were moved by waves under one metre in height and that the bed material in general could easily bet set in motion by waves of 1.7 metres and over. According to Seiichi Sato[3] bed movement in 6 metres can be classified as longshore drift which is assisted by mechanical turbulence in the bottom water relative to the seabed.

The bottom velocity due to surface waves in shallow water is expressed by:

$$u = c\,k\,b\cos k(x-ct)$$

$$v = 0$$

where

h = water depth, $k=\dfrac{2\pi}{L}$, $c=\dfrac{L}{T}$, $c^2=\dfrac{g}{k}\tanh kh$

$b=\dfrac{a}{\sinh kh}$ T = wave period L = wave length

$2a$ = wave height

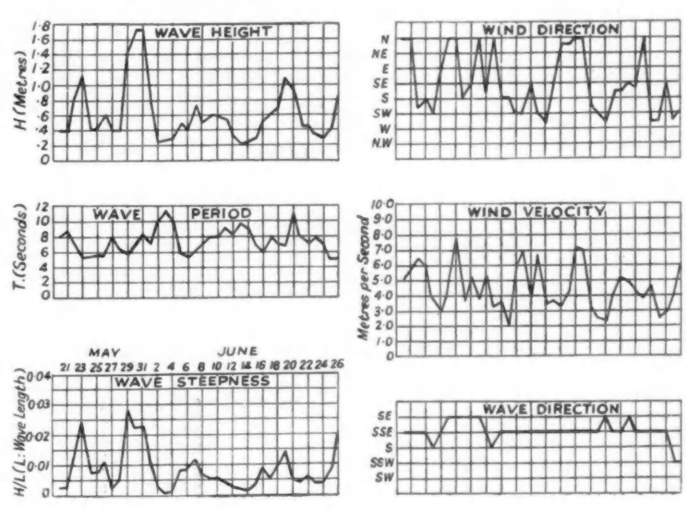
Therefore the velocity is the simple harmonic function of time and space and its maximum value is given by:

$$\text{maximum of } u = \frac{2\pi a}{T\sinh,\ \dfrac{2\pi h}{L}}$$

$$2\pi h$$

The brief relation between the mean diameter, d, of seabed particles and the critical velocity, u, was obtained by S. Sato[3]—$d=2.5\,u^2$, where d is in mm., and the critical velocity u is in m./sec.

Thus, from the maximum wave height for the period of this experiment, the mean velocity on the sea bottom u, due to wave motion, is calculated as follows.



The Measurement of Littoral Drift by Radio-Isotopes—continued

wave height = 2a = 1.7 m. wave period = T = 8 sec.
wave length = L = 65 m. (calculated by the theory of shallow water waves)
water depth = h = 7 m. (tidal range was about 1 m. at this time)

$$u = \frac{a\pi}{T \sinh \frac{2\pi h}{L}} = 0.72 \text{ m./sec.}$$

Hence the maximum diameter of grain which this mean velocity is able to move is:

$$d = 2.5.\ u^2 = 0.13 \text{ mm.}$$

It is known (Fig. 5), that the mean sand size at 6 metres is 0.13 mm. Accordingly, the mean diameter of radioactive material used for this experiment was about the same.

To sum up, it can be said that a wave height of about 1.7 metres is critical for moving bed material at 6 metres. Since the probable incidence of waves of 1.7 metres and more throughout the year is reckoned to be 7 per cent., the bottom at 6 metres can be considered to be a stable zone formed by wave motion. Moreover, as it has been shown that the mean sand size is almost constant from 6—8 metres, the bed material at the entrance to Tomakomai Harbour, which is 9 metres deep, will presumably be scarcely moved by wave action.

Conclusion.

These experiments have shown that this method is successful for revealing the facts of littoral drift and its complicated phenomena. The authors believe that this method is better than any conventional approach and that it can be applied to any coast in the world.

It is not certain, however, that the radio-isotope employed (Zinc-65) was the most suitable; it may be that Cobalt-60 is more suitable for a longer period of observation, while Scandium-46 would be better for a short term test. Experience has shown that the substance used can be manipulated with safety provided reasonable precautions are taken.

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Shore Marks for River Navigation

Economical Beacons in the Belgian Congo

The installation and maintenance of beacons on long stretches of inland waterway frequently costs more than the local revenue can afford. The following article indicates one way in which the problem has been solved in an economical manner. For a fuller treatment of the factors affecting the design of shore beacons for maximum visibility coupled with reduced costs the reader is referred to an article entitled "Marine Beacons," by Capt. G. D. Wall, in May, 1948, issue of this Journal.

Shore Marks for Day Navigation.

Before 1900, navigation in the Belgian Congo was done entirely with the help of shore sights. Books were compiled containing sketches of various difficult sections made by the masters of the steamers and corrected during each journey. Around 1900, considerable sums of money were made available for marking difficult sections and dangerous shoals by means of buoys and shore marks. The position of these marks were also noted down in the navigation books. In the course of subsequent years, the marks were in turn neglected, reinstated or further developed, and a pilot service was organised. Later on, the heavy tows were replaced by self-propelled vessels of small power and, therefore, the number of voyages made became insufficient for the pilots to keep themselves informed as regards the changes of the navigable channel. Reorganisation of the service, establishment of a complete system of marking, including buoys, shore marks, semaphores, etc., information stations and navigation books were completed around 1930. The pilot service has been abolished. The marking of the channels is now such that a master who possesses only a summary knowledge of the waterways can navigate from one mark to the next all along the route. The present system, therefore, not only serves to mark difficult passages but consists of a continued series indicating the route over its entire length

In general, the channels available to navigators have a minimum width of 200 m. In case this width is not available, marks are provided indicating exactly the limits of the channels. The marked route does not necessarily follow the line of the greatest depth in the river but rather stays near the bank in order to avoid as much as possible the use of buoys which are exposed to floating islands and may be displaced by collision with barges in a tow. It has been found that shore marks offer the safest solution and that their upkeep is less costly than that of buoys. Every master of the vessels navigating on the Congo river must have the official publi-

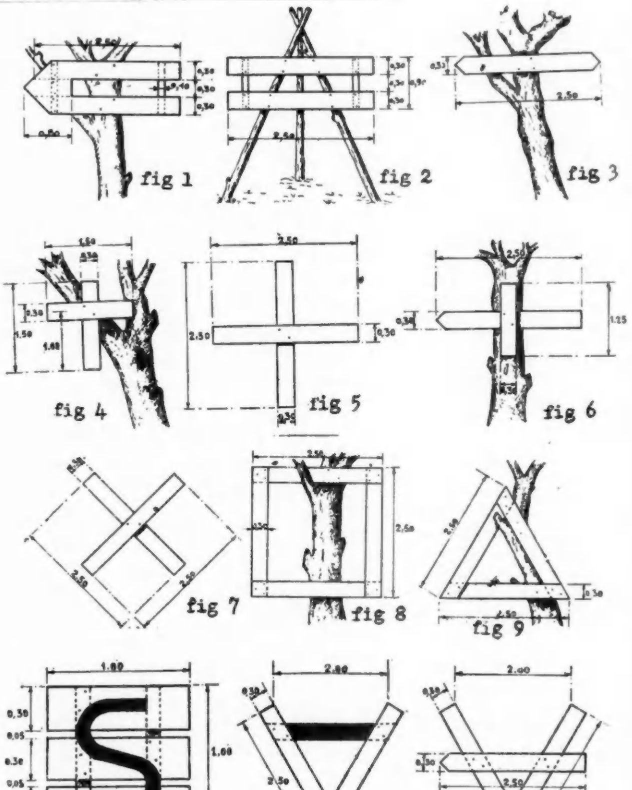


Fig. 1. Mark indicating bank to hug showing that the bank must be followed at a distance of 30 to 230 m. Fig. 2. Mark indicating bank to be approached and left immediately thereafter. After having approached this mark, the vessel must immediately be steered towards the next mark. Fig. 3. Mark indicating necessity to continue following the bank. Fig. 4. A Latin cross indicating danger in approaching the bank closer than 30 m. Fig. 5. Greek cross indicating danger in approaching the bank closer than 100 m. over a length of 300 m. (Two Greek crosses indicate danger in approaching the bank closer than 200 m. over a length of 600 m.). Fig. 6. Cross with arrow indicating a number of obstacles along the bank and the necessity to keep the middle of the channel. Fig. 7. St. Andrew's cross indicating a junction. Figs. 8 and 9. Bank marks. When going downstream, the squares (Fig. 8) must be left on the starboard and the triangles (Fig. 9) on the port hand side. These marks therefore take the place of the black and red buoys. Fig. 10. Warning mark indicating a narrow section with poor view. When sighting this mark, the master should blow the ship's whistle. Fig. 11. Mark indicating a suitable landing place. Fig. 12. The limit of an area suitable for landing.

Shore Marks for River Navigation—*continued*

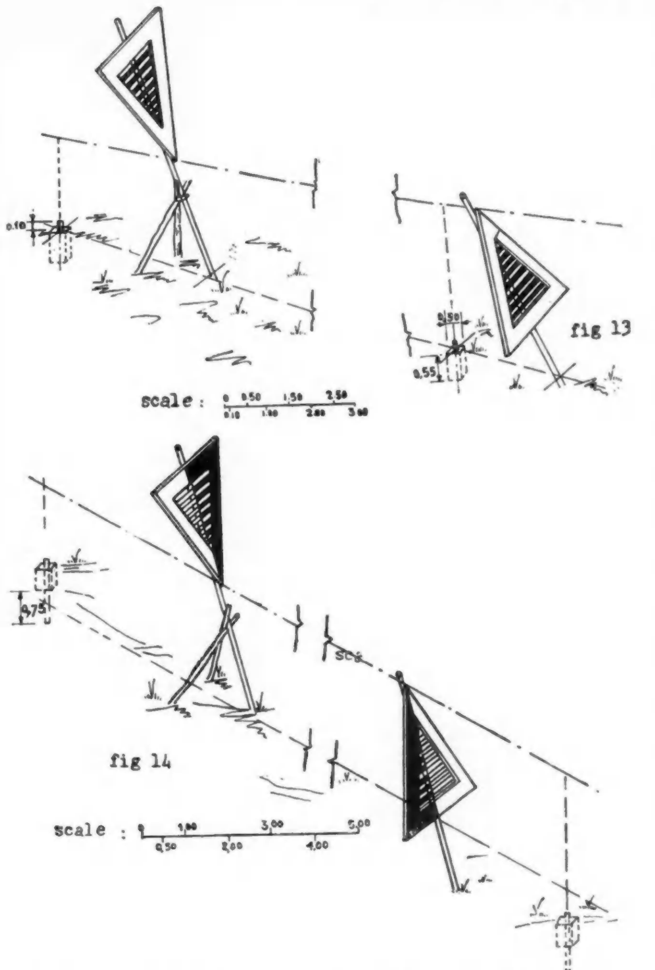


Fig. 13. Transit marks. These are used to mark narrow sections between dangerous submerged rocks and shoals. The triangles are painted white and the battens in the centre black. The width of the channel marked by each set of transit marks is indicated in the navigation books. Fig. 14. Limit of transit marks. These marks are placed to indicate the limit of a navigable channel. They are painted half white and half black or half white and half red, depending on which side of the channel the limit lies. The white parts of the marks cover the safe side of the channel.

cation in which the buoyed channel is indicated and in which also additional information has been given to facilitate finding the marks in times of poor visibility. The marks do not necessarily indicate the nature and location of snags and shoals but they do guide the navigator through safe channels. As a rule, and with the exception of sections located near a bank, a navigator will always see the next mark before having to leave the previous one. The marks used are shown in Figs. 1—15.

Marks For Night Navigation.

The possibility of night navigation on the Congo river and the Kasai river has often been considered. Around 1933, it was proposed to fit metallic mirrors on the buoys and on the shore marks and to fit the buoys with reflecting prisms so that the rays of the searchlights would be reflected. This system, however, had to be abandoned because the mirrors were stolen and the prisms were too heavy for the buoys. Later experiments with fluorescent paint were also unsuccessful because the fluorescence was insufficient at night, and in day-time the yellow colour of the paint made the marks poorly visible. Even at that time, in spite of the absence of lights or luminous shore marks, night navigation was often practised. With the aid of powerful searchlights, the masters were able to find shore marks and buoys at least in certain sections of the waterways but this obviously meant a heavy strain on the navigator and an added risk factor. The introduction of tugs equipped with diesel engines and screw propellers which did not have to stop frequently to load their wood fuel, the recent crises in transport which necessitated improved turn-round of vessels, and the ever-increasing capital investments required with modern equipment have led to the introduction of a continuous series of marks for night navigation which offer practically the same degree of safety as those used in day navigation.

Originally, plans were made based on the use of light buoys and beacons. However, these plans had some serious disadvantages and the investments required were exhorbitant whilst the anticipated maintenance cost and depreciation were very considerable. In view of this, the Administration decided to go back to the principle of using material with a reflecting power and leaving the light sources on board the vessels. In 1951 and 1952, after experiments which were carried out in co-operation with the transport companies, orders were placed for 300 ordinary buoys, 10 light buoys and 70,000 patches of aluminium with "scotchlite" reflecting paint. The principle of the new system is to give the same indications for night navigation as are available for navigation by day. Therefore, the navigator must not only be able to pick up the marks but also to identify them at the required distance. This has been possible by arranging the reflecting material in a special manner. The system adopted has proved satisfactory except on one large expanse of water where acetylene light buoys are being used for additional guidance especially when visibility is poor. The marks for night navigation were installed rapidly. The work was started in 1952 and finished in the first half of 1953.

The marks for navigation by day have been reproduced as well as possible both in shape and colour. The marks for night navigation which are fitted with reflecting patches can be seen in the light of a 1,000 watt searchlight with narrow beam at distances varying from 3 to 5 km. depending on the size of the mark and the colour of the scotchlite. On long stretches where the distance between marks is more than 2 km. light buoys have been used not because they are indispensable but to facilitate navigation in bad weather. Orientation at certain points is achieved by numbered marks. The marks for day navigation are provided with "wide angle" scotchlite which has the capacity to reflect light even

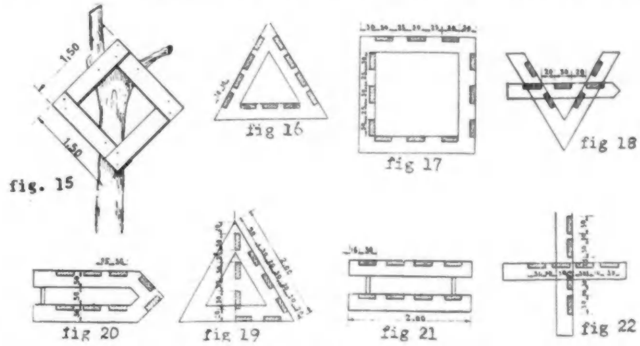


Fig. 15. End marks. The place where the limit transits cease to be applicable is marked with a diamond. Figs. 16 to 22 inclusive: Marks for night navigation. The shaded areas are treated with reflecting material in a variety of colours.

at an angle up to 80° Figures 16 to 22 show the arrangement of the reflecting patches used. Transits for night navigation are also provided with reflecting patches. They are fitted with large aluminium strips of 1.8 by 0.25 m. and of 1.8 by 0.10 m. bordered by series of reflecting patches of red, green, blue or white colour.

Improved Entrance into Lake Maracaibo.

Deep-sea ships with a draft of 36-ft. will be able to enter Lake Maracaibo next month. The National Canalisation Institute states that the work of opening a passage across the sand bar which closes the entrance to the lake from the Caribbean is virtually completed.

The next stage in the scheme is the building of a seawall projecting north from the bar, to prevent the sands from blocking the newly-opened passage. When the scheme is complete, Maracaibo, one of the world's richest oil centres, will be transformed into a seaport.

The Hopper Dredge

Its History, Development and Operation

A Review of a Publication by the Office of the Chief of Engineers, U.S. Army.

(Continued from page 250)

Dredge Pump Suction Assemblage.

The three types of hopper dredges, side-, centre-, and stern-dragarms have been mentioned earlier. The three types are dealt with in this section of the book under review but only the side-dragarm will be considered in this précis.

The suction assemblage comprises the drag, which is in contact with the bed material, a pipe connecting to a ball-joint, the latter permitting transverse movements of the pipe, a short pipe from the ball joint to the trunnion pipe which enters the hull through the trunnion bearing, and, inside the hull, the pipe connecting the trunnion pipe to the suction pump. Fig. 19 illustrates the drag-arm suction assemblage of the "Comber."

In modern dredges the trunnions are located forward of the hoppers close to the pivoting point of the vessel and so that the drag touches the channel bed as near as possible below the midship section of the vessel. This minimises the movement of the drag in rough weather, reduces the possibility of the drag ropes fouling the propeller, and of the hull fouling the dragarm when the vessel changes course during dredging.

In practice it has been found that improved performance results from the suction pipe diameter being greater than that of the discharge pipe and this is now the adopted practice in sea-going hopper dredges.

The ratios adopted in all dredges built since the "Pacific" (1937) which had a ratio of 2 to 1, are given in Table 4.

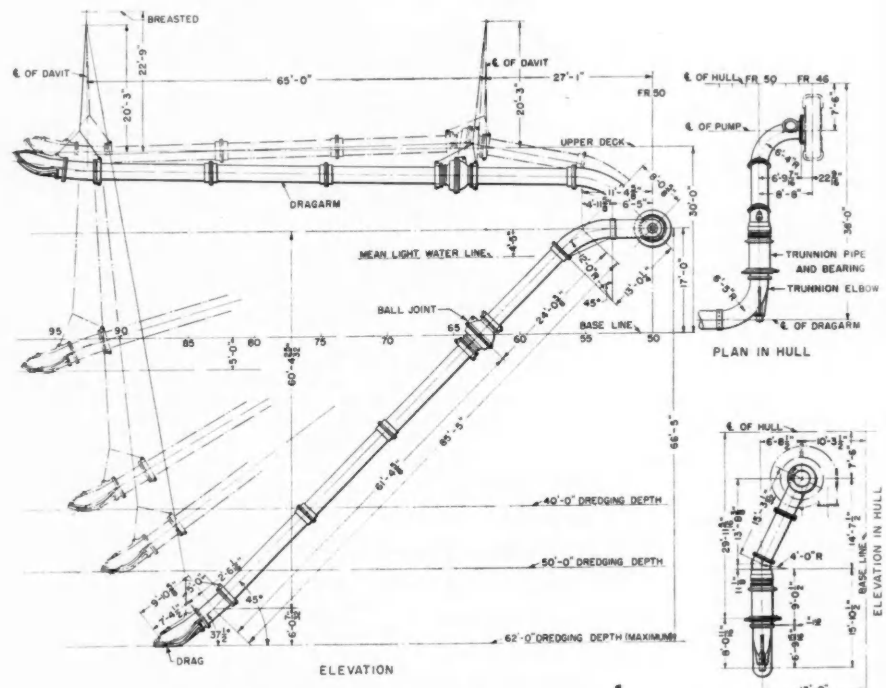


Fig. 19. Dredge "Comber"—side-dragarm assemblage.

Name	Dragarms per pump	Suction pipe diameter	Discharge pipe diameter	Ratio of areas
GOETHALS	1	32"	30"	1.14
HARDING	1	22"	20"	1.21
HAINS class	2	18"	20"	.81
COMBER class	1	30"	28"	1.15
ESSAYONS	1	36"	32"	1.27

TABLE 4.

Drags.

The drags will be discussed in detail later. The main classifications are the "Ambrose" for general purpose dredging, the "California" specifically for sand, the "Coral" developed for dredging at coral atolls in the Pacific Ocean, and the "Newport Bay" evolved for dredging a sloping bank of fine hard packed sand into which the other drags cannot settle.

Dragarm and Suction Pipes

The main pipe is built in sections usually less than 20-ft. long to facilitate assembly, renewal, etc., and of plates ranging from $\frac{1}{2}$-in. to 1-in. thick. Cast steel flanges are shrunk on and welded and machined after welding. Within the hull, the pipe is of cast steel between $1\frac{1}{2}$ to 3-in. thick depending on the bore. With a two dragarm dredge and a single pump where the length of pipe is long, the pipe is made up of a combination of steel castings and rolled plate sections. Prior to the construction of the "Taylor" in 1927, drag-arm pipes were rivetted. In modern dredges they have butt-welded seams and are made from hard, abrasion-resisting, steel plates.

Ball-Joints.

The ball-joint usually permits movement in all directions within an angular limit of 40°, within which limit it absorbs all the side movement and some of the vertical movement of the drag pipe.

In modern dredges the outreach of the davit supporting the ball-joint is from 6 to 8-ft. The drag davit has an outreach of up to 15-ft. The trunnion elbow is located as

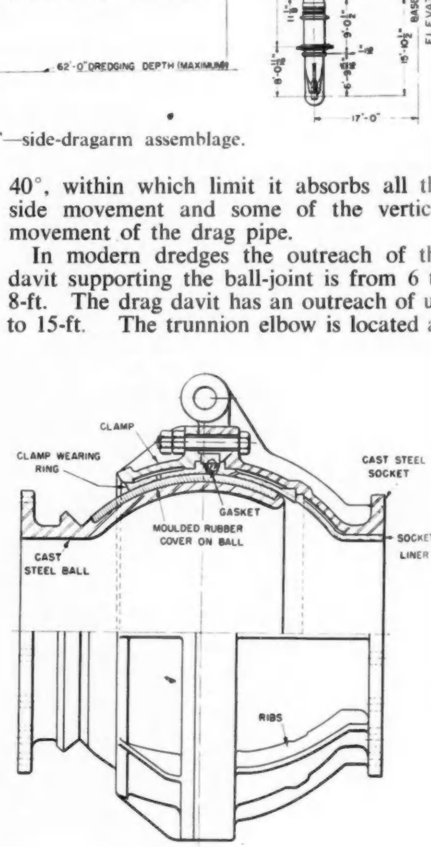


Fig. 20. Dredge "Pacific"—ball joint.

Hopper Dredge—continued

near to the hull as practicable. This arrangement presents an improvement over earlier ones where the drag and ball-joint were suspended much closer to the hull which thus more easily fouled the drag-pipe.

Prior to the "Pacific," built in 1937, ball-joints were of cast steel and consisted of three parts, a flanged ball, a flanged socket and a flanged retaining ring belted to the socket. Wear of all three parts, particularly in sand, was very rapid. Fig. 20 illustrates the ball-joint of the "Pacific," incorporating rubber, bonded on to the cast steel ball, and which was so successful that it was patented by the U.S. Government and has generally replaced all steel ball-joints.

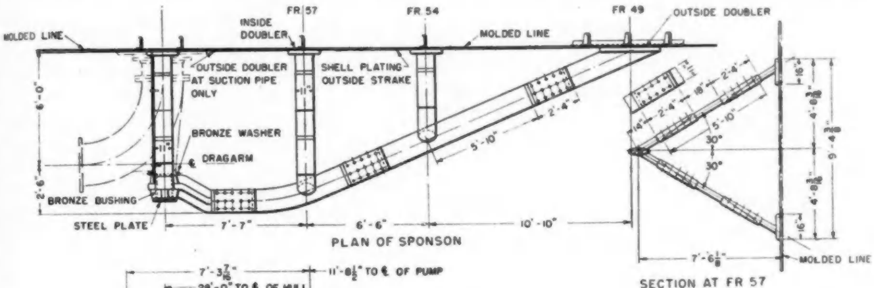
Jackets of rubber-covered ball-joints have a life of from 3 to 5 years and usually will take one refurnishing before rejacketing is required. Steel liners usually last 2 years and manganese bronze liners in contact with rubber about 3 years.

Trunnion Assemblies

The fixed type of trunnion assembly as fitted in the dredge "Harding" is illustrated in Fig. 21. The trunnion pipe passes through a bearing in the hull, via a stuffing box or seal to the pipe leading to the pump. The trunnion elbow is supported by a sponson which also protects it. The sponson frame is frequently submerged and causes considerable resistance, hence, in the "Hains" type dredges it is streamlined. In the "Comber" class the bow flare and the forward location of the trunnions rendered sponsons inadvisable. In a fixed trunnion assembly designed for, but not installed, in the "Essayons," the design was strong enough to obviate the need for a sponson.

Two types of sliding trunnions have been used, one in the "San Pablo" and the "Taylor," and another in the "Essayons." The latter is illustrated in Fig. 22, which illustrates the design. The trunnion elbow slides in the direction at right angles to the section.

The sliding trunnion presents many advantages. It enables the whole of the drag-arm assembly to be raised clear of the water when the dredge is running to dump, or in restricted waters. Sea voyages can be undertaken without special arrangements for stowing the drag-arms. The drag-arm, stowed on deck, is readily available for maintenance and repair.



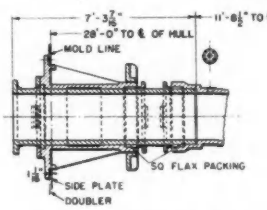


Fig. 21 (above). Dredge "Harding"—trunnion assembly and sponson.

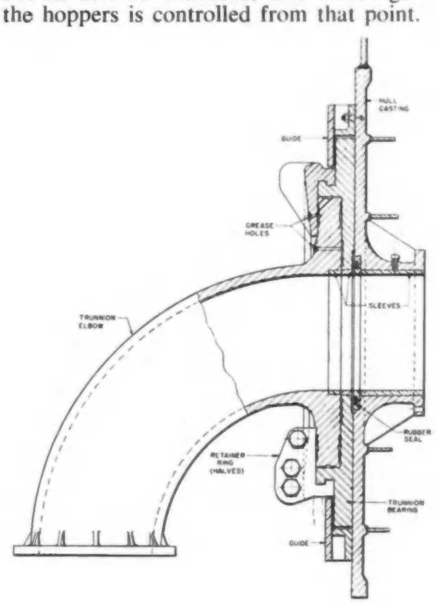
Fig. 22 (below). Dredge "Essayons"—sliding trunnion.

Dredge Pump Discharge Assemblage

The discharge piping is usually simple, extending as directly as practicable from the pump to the distribution system. The latter affects the dredging efficiency to a major degree and amongst other requirements it must provide flexible control of distribution of materials between the various hopper compartments, reduce the velocity of discharge into the hoppers so as to diminish turbulence, be reasonably splash-free, and provide for washing out empty hoppers.

Distribution Systems

Distribution systems are of three main types, viz. Open Trough, in which distribution is made be initial velocity of flow and trough gradient, but without pressure; Closed Pipeline in which pump pressure is available for discharging material at any point of the pipeline; and Closed Manifold in which pump pressure is carried to a central distribution box or manifold, and discharge to the hoppers is controlled from that point.



The nozzles for modern pipeline and manifold systems have adjustable control gates, but most of the outmoded open trough systems had ungated nozzles. Practically all installations include baffle plates or other stilling devices to reduce turbulence of discharge into the hoppers.

These systems are described and illustrated in detail in the manual. Only one system will be dealt with here. It is the closed pipe-line system in the "Goethals," which is a tanker type dredge and has a forward pumproom. It is illustrated in Fig. 23.

"Its two 32-in. diameter distribution pipes extend aft, over the four hoppers. Each pipeline forward of the first nozzle is fitted with a counterweighted flap valve installed to permit the dredge pumps to be primed. One pipe is located on the port side and the other on the starboard side, about 5-ft. from the centreline of the dredge, and each has eight discharge nozzles. Corresponding nozzles of the two pipes confront one another, and the mixture discharged from them meets on a wide splash plate mounted symmetrically on a longitudinal centreline beam.

"Perforated baffles were originally installed on both sides of the splash plate in the way of the nozzles to catch stones, but were found unnecessary and were removed. The nozzles, about 1-ft. long, originally discharged above the level of the overflow troughs located along the outboard sides of the hoppers. High velocity flow from these nozzles caused considerable turbulence in the hoppers and consequently retarded settlement. In order to reduce turbulence and improve settlement, the overflow troughs in Hoppers Nos. 1, 2 and 3 were boarded up and the overflow level in Hopper No. 4 raised about 2-ft. This change increased the hopper capacity to 5,448 cubic yards and placed all nozzle openings below the overflow level.

"Another fault with the system as originally constructed was that high velocity flow in the pipes caused the material to pass by the two pairs of nozzles in Hopper No. 1. Baffles were installed to force the mixture out of these nozzles after which they functioned satisfactorily.

"The method of introducing the mixture into the hoppers of the 'Goethals' by the improved distribution system achieves excellent results. The opposing streams discharged from each pair of nozzles onto the midship splash plate causes a considerable amount of turbulence in the space between the two discharge pipes, which are partially submerged. As a result of this turbulence in a confined space, the mixture discharged from each pair of nozzles is well distributed forward and aft and is of quite uniform consistency as it passes outboard beneath the two discharge pipes. The layer of slowly moving liquid in Hoppers Nos. 1, 2 and 3, turns 90° in moving aft and all overboard overflow is from the sides of Hopper No. 4. Since all discharge nozzles are submerged, the pipes are completely filled with liquid, resulting in progressively lower distribution pipe velocity from Hopper No. 1 to Hopper No. 4. The turbulence between the discharge pipes is, therefore, greatest at Hopper

Hopper Dredge—continued

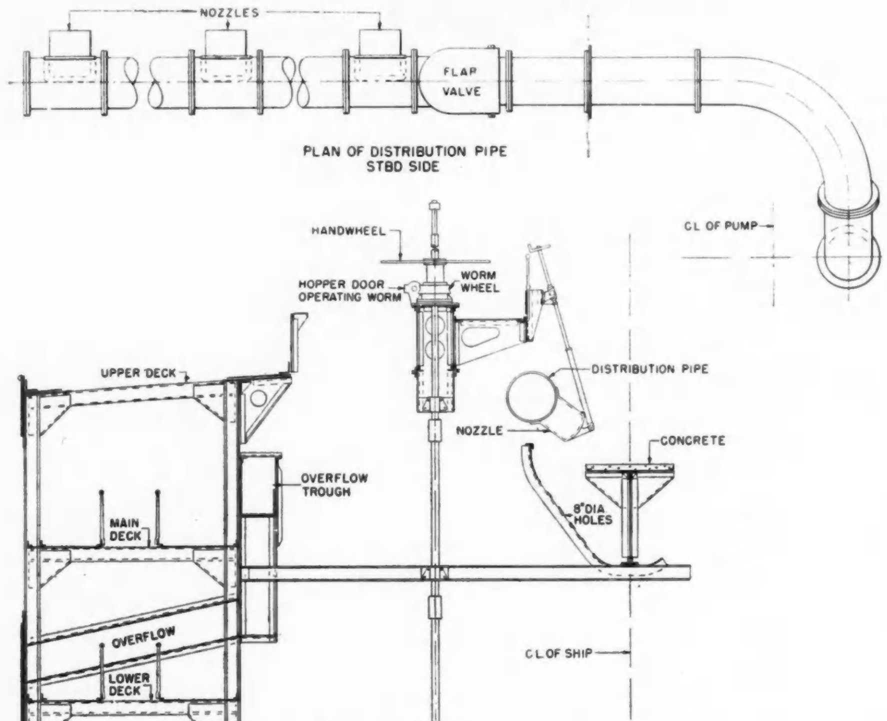


Fig. 23. Dredge "Goethals"—pipeline distribution system.

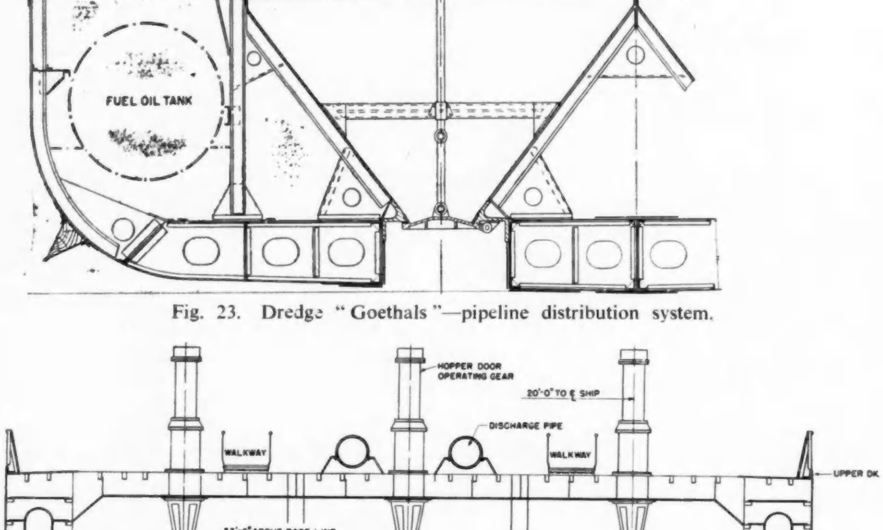


Fig. 24. Dredge "Essayons"—section through hoppers, with plated upper deck.

No. 1, but the settling time for the solids discharged therein is also the greatest. Turbulence is least in Hopper No. 4, where little settling time exists. Since there is no complete centreline bulkhead in the hoppers of the 'Goethals' and the transverse bulkheads between hoppers are 2-ft. or more below overflow level, flow between hoppers is practically unrestricted.

"The high transverse stability of the 'Goethals' provides resistance to listing, and progressive overflow from hopper to hopper with greatest discharge into Hopper No. 1 tends to equalise the loads in the hoppers. Each type of material dredged requires a different adjustment of the nozzle gates which, however, can usually be determined during dredging of the first few loads. The nozzle adjustment remains practically unchanged during the loading period."

Both of the current systems (the closed pipeline and the closed manifold), have their advantages and disadvantages and are the subject of continual development by the Corps of Engineers. The system installed in the "Essayons" is a combination of the manifold and pipe line systems.

Hopper and Overflow Systems.

The hopper section in the modern tanker-type dredge in most cases is a single unit located between the pump room and the power plant, and because of stability requirements is divided into a number of compartments each of which has one or two dump doors and is designated as a "hopper."

The objective in arriving at the surface area at overflow level, the position of the overflow troughs and the system of distribution is to provide as low a surface velocity and as long a path as practicable between the discharge nozzles and the overflow troughs. As stated earlier 1 square foot of surface area to 2½ cubic feet per minute pump capacity has been found to give good results.

The slopes of the lower part of the hoppers in earlier dredges was 40°, but at this slope an unsatisfactory amount of material remained in the hoppers when dumping and it was increased to 50°. The "Comber" class and the "Essayons" have 60° slopes. In modern dredges the hoppers are either constructed of abrasion resisting steels or are lined with this material at critical points.

Hopper dredges of the Corps of Engineers are necessarily designed for the heavier type of material likely to be handled, namely fine sand of density about 125 lb. per cubic foot. Thus when dredging lighter material such as mud and silt (about 80 lb. per cubic foot) the design draft would enable them to carry appreciably more material than the hopper capacity will permit. This is overcome, but only to a small extent, by the use of portable or fixed flash-boards, usually of wood.

Hoppers, Small Dredges.

In the "Absecon," built in 1914, and of 300 cu. yd. capacity, side discharge doors are provided, enabling the dredge to dump in very shallow water or even when grounded. The "Pacific" is a dual-draft, tanker type dredge built in 1937, her capacities being either 300 or 500 cu. yd. The upper part of

Hopper Dredge—continued

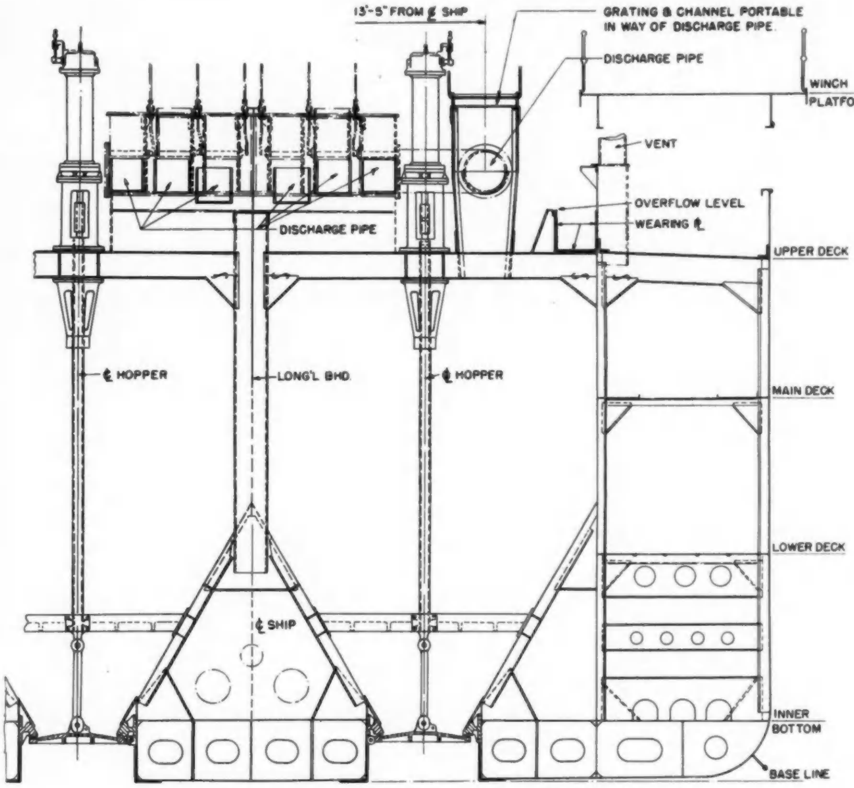


Fig. 25. Dredge "Comber"—section through hoppers.

the outboard side of each hopper is a single movable weir gate. When raised, overflow occurs over the fixed sides and a capacity of 300 cu. yd. is provided. When lowered, overflow occurs over the gate giving a capacity of 500 cu. yd. Dumping is through hydraulically operated, hinged doors.

In the "Lyman" class, built in 1945, three capacities are available. For 300 cu. yd. capacity, openings 1-ft. 6-in. high by 7-ft. 3-in. long, covered by gates are provided in the lower part of the outboard sides of each hopper. For 668 cu. yd. capacity, overflow occurs over the hopper sides. Upper gates at the top of the outboard sides, 1-ft. high by 26-ft. wide enable the capacity to be increased to 722 cu. yd.

Hoppers, Large Dredges.

In large hopper dredges (1,200 to 8,000 cu. yd.) the large concentration of load in the midship section creates design difficulties. In dredges over 5,000 cu. yd. capacity the problem becomes complex, and in the "Essayons" it was necessary to plate practically oll of the upper deck above the hopper, an undesirable feature from the operating viewpoint (Fig. 24). The hoppers in the "Comber" (of 3,000 cu. yd. capacity) are illustrated in Fig. 25. The hopper doors, of which there are two to each hopper, are 4-ft. 8-in. by 4-ft. 4-in. The total hopper section is 91-ft. long by 40-ft. wide.

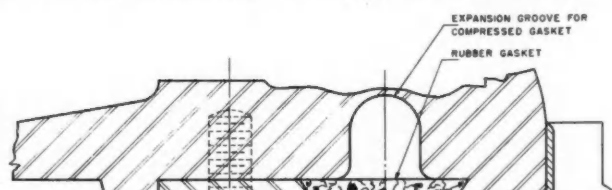


Fig. 26. Dredge "Pacific"—rubber gaskets for hopper door.

Dump Doors.

All American hopper dredges constructed to date have hopper dump doors of the hinged type generally raised and lowered by vertical rods connected through links to lugs on the top surface of the doors. The mechanical efficiency of the linkage is low, annual renewal of parts being necessary, and the linkage forms an obstruction in the door opening and thus catches ropes, canvas and other rubbish. The wells into which the doors open are subject to considerable wear and create much resistance to the full speed movement of the dredge. However, the arrangement is well tried and has given good service in severe conditions.

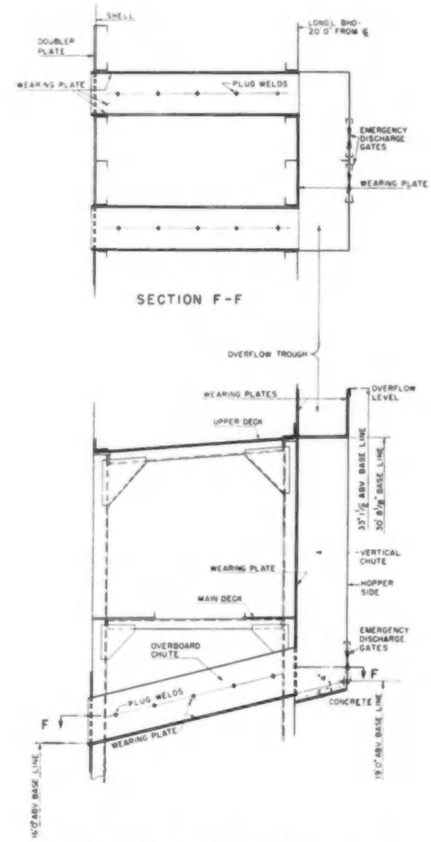


Fig. 27. Dredge "Comber"—hopper overflow arrangement.

Other devices have been considered, one of which was a double leaf door, considered for, but not installed in, the "Essayons." Dump valves of the cylindrical and conical type have also been considered and an experimental valve of the latter type has been tried with some success in the "Mackenzie."

In earlier dredges, when no special sealing device was used, leakage through dump doors was serious. Rubber gaskets were inserted in the doors of the "Kingman" class dredges, and an improved seal, first installed in the "Pacific," and illustrated in Fig. 26, which has proved efficient and low in maintenance costs, has been used in all recently constructed hopper dredges.

Door operating gear, employing hydraulic power directly applied to the dump door rods, first tried in the "Cumberland" and provided in the "Savannah" built in 1922, has proved simple, efficient and economical

Hopper Dredge—continued

and has been adopted as standard for all recent dredges except the "Goethals," where horizontal shafts, electric-motor driven, operate through clutches to rotate nuts threaded on to vertical shafts connected to the dump doors.

Overflow Systems.

In some of the earlier dredges the overflow from the hoppers spilled over the hopper coamings on to the deck and thence overside. For many years however the system has been to provide troughs which receive the overflow

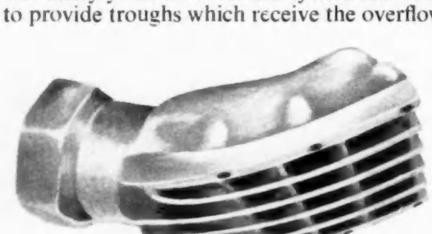


Fig. 28. Model Ambrose drag.

and discharge it into vertical chutes and thence through the hull. Fig. 27 illustrates the trough arrangements in the "Comber" where they extend full length on each side of the hopper section. In the "Essayons" the troughs run athwartships and are located at the end of each set of three hoppers. They discharge to the port side only. This arrangement led to difficulties during trials when a list to starboard developed due to unequal settlement in the hoppers. The overflow troughs, designed to discharge to port did not operate efficiently under these circumstances, and the list increased, permitting material to overflow from hoppers into adjacent starboard hoppers and thereby increasing the unstable condition until a starboard list of 12° was reached. Trim was restored by partially discharging. The arrangement was improved by breaking up the free surface of liquid in the hoppers by, in effect, raising the level of the longitudinal bulkheads between hoppers. This, with certain other improvements has led to the list being restricted to a maximum of 2°.

Fig. 27 also indicates the emergency discharge gates which enable part of the load to be discharged should the dredge run aground, and render the dump doors impossible to open.

Drags

The type of drag developed by the German engineer Fruehling and common in Europe was provided for a large number of American dredges. It was found to be effective in soft mud but not in sand. The propulsion power required was sometimes found to exceed that which was available.

The drags developed in the United States and used by the Corps of Engineers are of three types; fixed, adjustable and self adjusting. Types have been developed for special duties and development still continues.

The bottom surface gratings are generally rectangular and a surface area having a ratio of 3 to 1 to the area of the suction pipe has been found suitable. The width of the drag is greater than the length, the ratios in the "Mackenzie," "Comber" and "Essayons" being 1.25, 1.43 and 1.35 respectively. It is considered that the future trend may be towards wider drags. It is indicated that the size of the openings in the gratings are satisfactory if the openings are approximately square, and if the largest side is 10 per cent. shorter than the dimensions in the pumping system controlling the maximum size of material that can be handled.

Ambrose Fixed Drag

Because of its simplicity, robustness, relative cheapess and efficiency in dredging mud, silt, or other loose material, the Ambrose drag has been the standard fixed drag since the early 1890's. It is not efficient in dredging fine and medium hard packed sand, in channel widening in sand where the side slopes exceed 1 in 5 or in dredging blasted coral. Where the depth variations cause constant changes in the inclination of the dragarm, the fixed drag does not maintain close contact with the bottom. On side slopes drags of this type tend to slide down towards the ship. The drag is illustrated in Fig. 28.

California Self-Adjusting Drag

In certain locations, the depth of water in which dredging occurs may range considerably leading to variations in bottom contact of fixed drags of the Ambrose type, with consequent fluctuations in the volume of intake. Experience in 1924 on the ocean bar at San Francisco led to model and prototype experiments of a type of drag which would automatically adjust itself to maintain constant contact of the entire grating area on the bottom at all prevailing angles of the dragarm. This drag, which later became known as the "California Drag," proved to be outstandingly successful in sand in which it is far superior to the Ambrose, and the equal of the Ambrose in mud and silt. The latest type installed in the "Essayons" is illustrated in Fig. 29.

Other Types of Drags.

Tests have been made of an adaption of the California drag fitted with toothed bars and with the after body of the drag power-loaded so as to prevent its lifting of the bottom. The toothed bars have proved promising but not the power loading.

"Coral" drags were first used on the "Mackenzie" in 1940, although coral dredging by hopper dredges has been performed with Ambrose and San Francisco drags since 1929. The "Coral" drag, with a body fabricated of abrasion-resisting steel plates to which is attached a hinged gate section that can be adjusted for three dredging positions, has proved to be very efficient.

Other drags which have proved successful are the "San Francisco Bay" developed for work in the bay from which it takes its name, and "Newport Bay" which was designed for side bank dredging of fine hard-packed sand where the bank slopes were approximately 1 vertical to 2 horizontal and where the California Drag proved unsuitable. In the Newport Bay the longitudinal members of the grating are developed into thin serrated blades which bite into the bed material.

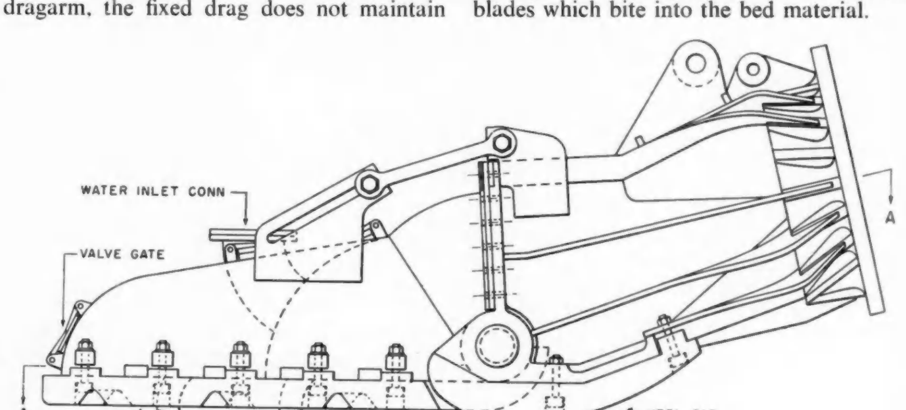


Fig. 29. Dredge "Essayons"—modern California type drag.

Other Developments.

Various drag appurtenances have been tried. Mechanical agitators have not proved effective. Nor generally, have jets, mainly because of the relatively high power required to pump an adequate supply of water at the required pressure. Scarifier teeth have usually proved ineffective an experiments with discplow devices have been disappointing. Tests with blades fitted to drags have indicated promise.

The water inlet pipe is now a standard drag fitting in dredges working in mud. This fitting enables the drag to remain buried deep in the mud whilst preventing the dredged mixture from becoming so dense as to clog the pumps. Before this fitting was developed in 1927, it was necessary to raise the drag to prevent choking, and large variations in density resulted. The fitting comprises a pipe connected to openings in the drag top extending up the dragarm into clear water. The upper end is fitted with an adjustable cover, which enables the volume of water added to be controlled. The control is not automatic and has to be pre-set for each cut.

(To be continued)

Food Inspection in the Port of London

By P. W. COOMBE, M.S.I.A.*
(Food Inspector, Port of London Health Authority)

Introduction

THE Port of London Health Authority has jurisdiction over all matters concerning public health which arise within the Port limits. These limits extend from Teddington Lock to Warden point in the Isle of Sheppey, a distance of 68½ miles, and within them there are six dock groups with a lineal quayage of 45¾ miles.

The subject of this article is that large part of the Port Health Authority's work which concerns the precautions taken in the public interest to see that all foodstuffs which are landed in the Port of London are fit for human consumption.

Powers of the Port Health Authority

The Authority derives its powers from an Act of Parliament, which constituted the Authority in 1872, and from subsequent Acts and Statutory Instruments which control the production and importation of foodstuffs. Of these, the Act which shows most clearly the immediate powers of inspection and preventive action which are vested in the Authority, is the Public Health (Imported Food) Regulations, 1937—Part II—All Food. The following selected clauses show both the liabilities of importers of food and the duties of the Port Health Authority in ensuring that the food is fit to be passed on to the public:

Para. 6. A person shall not import into England or Wales for sale for human consumption any article of food which has been examined by a competent authority and not found at the time of examination to be fit for human consumption or any article of food in the manufacture or preparation of which any such article as aforesaid has been used.

Para. 7 (1). The medical officer of health may examine any article of food which has been landed within the district and where the circumstances, in his opinion, so require, he may examine an article of food while it is on board a ship within the district or after it has been delivered overside and before it has been landed.

(2). The master of a ship and every person having the custody of any lands or premises within the district shall, at the request of the medical officer of health, afford him access to the ship or to the lands or premises, at any reasonable time, for the examination of any article of food which is on board the ship or which has been deposited on the lands or premises.

(3). The importer, the master of the ship and every person having the custody of any lands or premises shall, at the request of the medical officer of health, afford, by the convenient and suitable arrangement, unpacking or uncovering of so much of the cargo or of any consignment delivered overside or landed or deposited on the lands or premises, as comprises articles of food, all such facilities as the medical officer of health may reasonably require for the examination of the article of food. He shall also afford such other facilities as the medical officer of health may reasonably require for the purposes of these regulations.

(4). Where the medical officer of health has reason to believe that an article of food, which has been landed within the district is deposited on any lands or premises within the district and access to the lands or premises at a reasonable time, for the examination of the article of food by the medical officer of health, has been refused by the person having the custody of the lands or premises, the medical officer of health may make complaint to a justice.

The justice may thereupon by a warrant authorise the medical officer of health to enter the lands or premises and to search for and examine any article of food deposited thereon.

Para. 8 (1). The medical officer of health may take a sample from any consignment of articles of food for any purpose of these regulations and, subject to paragraph (2) of this regulation, shall dispose of the sample in such manner as the sanitary authority direct.

(2). Where the medical officer of health who takes a sample from a consignment of articles of food is of opinion that special procedure is necessary for the examination of the articles of food or where, at the request of the importer, the medical officer of health who takes any such sample has recourse to special procedure for the examination of the articles of food, the importer and every person who has the custody or control of the consignment shall afford all such facilities as the medical officer of health may reasonably require for the completion of his examination of the articles of food and, during such time, not exceeding forty-eight hours, as the medical officer of health by notice in writing appoints or during any longer time which he by notice in writing appoints and to which the importer has consented, he shall not, without permission of the medical officer of health, remove any such articles of food except to any such place as may be specified in the notice.

Para. 9 (1). If on examination, the medical officer of health is of opinion that an article of food is diseased or unsound or unwholesome or unfit for human consumption, he may himself or by an assistant seize and carry away the articles of food or he may by

No. 6 food store which is equipped with special facilities for meat examination.

*A Paper presented at the 62nd Annual Conference of the Sanitary Inspectors' Association held at Scarborough from 13th to 16th September, 1955, and reprinted by permission of the Association.

Food Inspection in the Port of London—continued

a notice in writing to the importer or to the master of the ship or to any other person having charge of the article of food require that, until it has been dealt with by a justice, it shall not, without the permission of the medical officer of health, be removed from the place of examination or from any other place specified in the notice and in either case the medical officer of health may apply to a justice to deal with the article of food under Regulation 15 of these Regulations (Part IV—Judicial Proceedings, etc.).

Procedure for Detention of Unsound Food

Each dock group has its own port health office, and the result of each day's work is conveyed to the head office at Guildhall in the City of London by post, the inspectorate visiting head office one day a month, unless a matter requires their attendance some other time. This situation requires more forms than would normally be used where the inspectorate commence from and return to head office each day.

Foodstuffs found to be unsound are detained by the food inspector by serving detention notices on the wharfingers, customs, copy by post to the importer and special detention form to the medical officer of health, the latter sending out the seizure notice to the importer, the importer can surrender the goods or elect to have the goods taken before the court. It is very satisfactory to record that with very few exceptions the importers surrender the goods to the medical officer of health for destruction. The destruction of foodstuffs must be made under the control of the medical officer of health and customs. Where possible the disposal of unsound food for some industrial purpose is allowed, under strict supervision, and guarantees must be given by the person purchasing as well as the person selling the goods. Before permission is given for removal, the consent of the medical officer of health of the district where it is intended to send the goods must first be obtained

Unloading carcases.

to enable him to see that the terms of the guarantee are complied with. The district inspector always issues notices of release to each person who has received a detention notice.

Food Inspection

The fact that the Port of London extends over such a wide area and that foodstuffs may be landed at almost any point makes it impossible to divide the staff strictly into food inspectors and sanitary inspectors. There are certain parts of the docks where the nature and quantity of the foodstuffs landed are such that a whole-time food inspector is essential, but there are many districts where the food inspection and sanitary inspection must be combined. For this reason every sanitary inspector in the port is required to qualify as a food inspector.

At present the inspectorate consists of a chief inspector, senior sanitary inspector and fifteen inspectors, who work as follows:

Whole-time food inspection—Senior Sanitary Inspector and 1 Sanitary Inspector.

Cold stores inspector—1 Sanitary Inspector.

Food and sanitary inspection—12 Sanitary Inspectors.

Duties of Food Inspector Acting on Behalf of the Medical Officer of Health.

So great are the food imports in London that it is obviously impossible for everything to come under inspection. At the same time, the control is greater than might at first appear possible, for inspectors have not only the information contained in the customs

Offal examination.

bill of entry at their disposal, but, apart from the fact that they are constantly on the docks, they have many sources of information open to them, both from H.M. Customs and the wharfingers. Above all, they receive every assistance from the importers, who do not wish to put food of even doubtful quality on the market.

The person appointed to a district as a food inspector endeavours to visit the various departments in his district at least twice a day, or so often as the circumstances may require. This is necessary to find out what foodstuffs have been landed and to examine such articles of food customs may be clearing. Foodstuffs may be landed direct from ship to shore or may be brought into the district by lighter, road and rail transport.

All cargoes carried in a ship are entered on the ship's manifest (which gives quantity, description, indentification marks, weight, consignor and consignee), a copy of which is deposited with the wharfingers, and is available to the food inspector. By this means he can ascertain all foodstuffs in the ship. The wharfingers will inform the inspector which of the cargo is being landed in his district and that which will be discharged overside for landing outside his district.

Foodstuffs discharged overside into lighters are frequently not cleared by Customs until they reach their destination. It is therefore the responsibility of the food inspector at that place of landing to make the examination. There are seven riparian authorities on the Thames where foodstuffs are landed, and who are empowered to carry out the Imported Food Regulations, there being Cold Stores and Bonded Warehouses in their districts. There is close liaison and co-operation between these authorities and the port health authority.

The Examination of Food

The docks are divided into two groups, viz., transit docks and warehouse docks.

Foodstuffs landed in the transit docks only remain in the sheds or warehouses for a day or so to be cleared and then leave the dock on delivery. It is therefore necessary that the food inspector should

Food Inspection in the Port of London—continued

keep in close contact with the Customs to find out which goods are being cleared and to make his examination at the same time.

Quantities of foodstuffs are landed into the warehouse docks or removed from transit docks to warehouse docks, for warehousing for long periods. Whilst on the first examination they may have been passed as sound, decomposition may take place during storage. It is, therefore, necessary to inspect from time to time any foodstuffs which are kept in storage for lengthy periods.

Foodstuffs are frequently landed and placed into a bonded warehouse, where they may remain some time before the duty is paid. Goods so warehoused are not available to the food inspector until duty has been paid. It will therefore be appreciated that a careful examination must be made before the goods go on delivery.

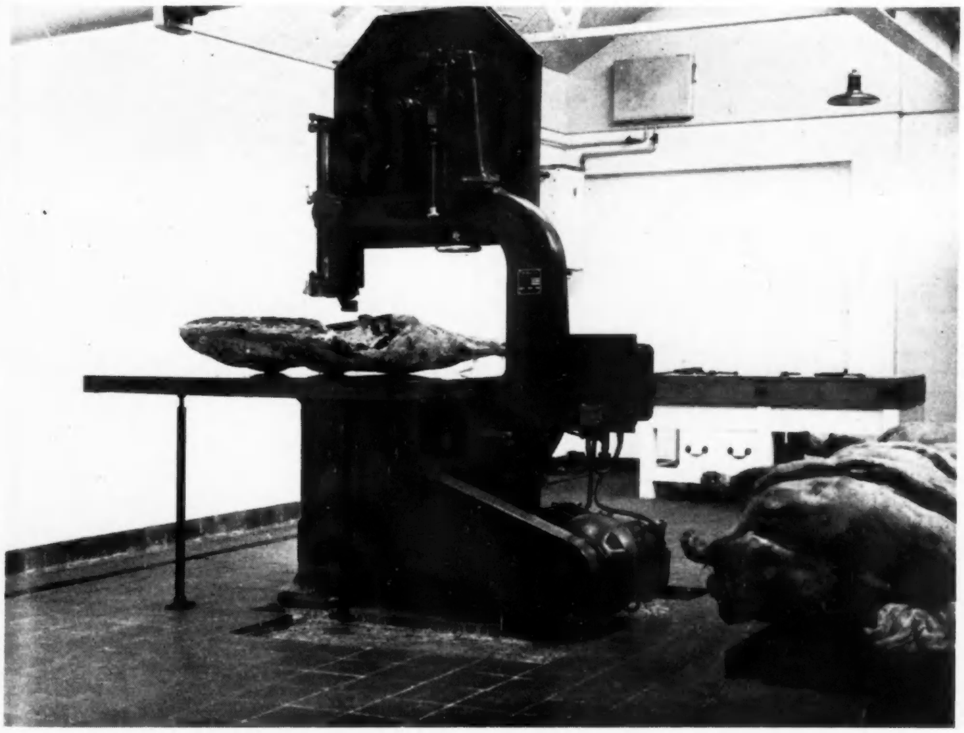
Canned goods in prolonged storage will often develop a blown and leaky condition. Micro-organisms may lie dormant in a canned product for a considerable time, and only become active when the temperature is suitable. The port health ensure that canned goods are stored in cool and suitable warehouses.

The food inspector makes an external examination of all foodstuffs as soon after landing as possible to observe any abnormal condition, such as stained or damaged packages or bags, instructing the wharfingers to separate the clean, sound packages from the stained. This is absolutely necessary for the subsequent examination.

There is no standard laid down as to how many packages or bags shall be examined by the inspector; it has been said that a three per cent. or five per cent. should be opened, but this is not the practice in London, for with consignments of canned goods frequently running into packages of thousands it would be necessary to open up 30-40 or 50 packages. The food inspector may exercise his discretion as to the extent of his inspection and he will, in the first place, be guided by the appearance of the cases. If the cases show no evidence of staining and he has previous satisfactory evidence of the same foods from the same source, he may be satisfied to open a few cases and a few cans at random. If the cases are stained he should open all cases so affected and his further inspection should then be based on his findings. A sufficient number of apparently sound packages should be examined in order to justify a decision. A similar percentage of cases should be opened if previous consignments of the same product from the same source have proved unsatisfactory. If in the cases examined, three per cent. or more of the cans are found to be unsound, he should examine a further five per cent. and so long as the percentage of unsoundness continues to be three per cent. or over, he should detain the goods and request the importer to carry out a "full and sound" examination, that is a 100 per cent. examination under the supervision of the food inspector of all cases or containers, to ascertain the exact number of defective tins in the consignment. On completion of this examination the sound tins are immediately released and a seizure notice issued for the unsound tins, their ultimate disposal being decided by the medical officer of health.

The sorting of foodstuffs within the Port of London Authority docks is done by their own expert personnel under the supervision of the food inspector; the authority will not allow any operations to be carried out except by their own staff; in every case the importer or his agent is required to give his instructions in writing to the dock company guaranteeing to meet the cost of the operation.

The commonest defects found with imported canned foods is the blown tin, leaky tin, repaired or re-soldered tin, bad rust, slack cap, collapsed tin, and last but by no means least, the "washy tin."



Bandsaw in the cutting shop.

There are various types of micro-organisms that can decompose canned meats and fish without making their presence known by the production of gas in the early stages, but by attacking the protein, produce liquifaction, which is commonly termed "washy tin."

There are a number of types of "pork meats" which are canned in their own juices, i.e. "pork in natural juice," where the liquid that the pork has been boiled in is canned; these should not be mistaken for "washy tins."

It is the practice of canners to vent certain canned meats, i.e., pierce and solder over; this is quite legitimate providing a protection disc has been placed inside the can to prevent the product being sucked up by the vacuum pump, and to protect the contents from solder droppings when the vent hole is sealed. These cans do not come under the heading of "repaired or re-soldered tins."

Bad packing is also responsible for much damage to large tins through heavy handling in transit, causing the tins to ride on each other, resulting in leaks, especially where there is a bad fabrication of tins, such as crimping of caps on the outside instead of inside. Embossed lettering and numbers too heavily impressed on a thin gauge tin frequently result in pin hole leaks.

With the advent of de-rationing the imports of foodstuffs have considerably increased from all parts of the world, and in particular from the Commonwealth and Dominion contries, with the Continental countries bidding for trade.

As one would expect, many new food factories were opened up in these exporting countries, and it was soon evident that quite a lot of indifferent canned foodstuffs were being shipped to this country and that food inspectors would have to be very much on the alert at the ports.

The canned meat products were found to be badly canned; large consignments of corned beef with cereal, hams, beef brisket, etc., were arriving in tins with soldering round the caps and evidence of having been pierced and re-soldered; the Continental hams in particular giving trouble, no doubt due to the indifferent handling at the food factory. Hams are not cooked too high or for long, so

Food Inspection in the Port of London—continued

as to prevent shrinkage; seldom does the cooking temperature exceed 200°F., leaving the ham processed or pasteurised, but not sterilised.

It soon became evident to both consignor and consignee that the examination by the port health authority and the subsequent rejection of the goods could only result in heavy financial losses. So the "trade" took the matter in hand and gradually these undesirable imports stopped, until today the standard of canned foodstuffs sent to this country are showing that high standard of canning which we enjoyed prior to the war.

Both the analyst and bacteriologist have played an important part in bringing about this improved condition; for, of course, the medical officer of health has had to rely on their reports when coming to a decision on the action to be taken with a particular consignment.

Attention is paid to imports of fruit and vegetables. All consignments of apples and bananas are carefully examined for the presence of arsenic sediment on the fruit resulting from arsenical sprays used on the trees; this condition was fairly prevalent before 1939, but to-day is rare. Consignments found contaminated are stopped for washing before release to the retail trade.

With the imports of bananas there is usually a quantity of waste, due to over-ripeness or stem rot. Where possible the waste is released under suitable guarantees for making into pig food.

Preservatives and Metals in Food

Continuous formal and informal sampling is carried out in accordance with the Public Health (Preservatives, etc., in Food) Regulations for the presence of metals, prohibited preservatives and colouring matter in all types of imported foodstuffs.

Imported fruit pulps and juices arrive in barrels with sulphur dioxide preservative higher than that allowed by the regulations. This is not an offence providing the manufacturer can break down the product and show that the final product does not contain a quantity of SO_2 in excess of the permitted amount laid down in the regulations.

Although there are no legal standards in this country for metals in foodstuffs, the Food Standards Committee in their many reports have made recommendations as to the maximum amount of metals permitted in the foodstuffs already studied by that committee, and it is to be hoped that it will not be long before they have the force of law.

Food inspection is a complex subject and, although a vast amount of books and information is available, food inspection in the long run is a question of experience, but a team made up of the food inspector, analyst and bacteriologist can put up a satisfactory barrier against the possibility of imported unsound or unwholesome food getting to the public; in the Port of London we hope this is so.

Importation of Meat

Of the total meat imports into the United Kingdom, approximately 60/70 per cent. passes through the Port of London, the bulk being discharged from ships berthed in the Royal Docks Group (King George V Dock, Royal Albert Dock and Royal Victoira Dock), where a quantity is unloaded into insulated lighters for removal to riverside wharves for landing, but by far the greater quantity is landed on to the dock quays, where it is immediately loaded into insulated road and rail vans for destinations covering London and all counties as far north as Glasgow. Naturally the aim of all meat importers is to ensure that the meat arrives at its destination in the best possible condition, and in this connection solid CO_2 is used where the destination is a considerable distance from the docks.

Meat importers cover chilled and frozen beef, frozen mutton and lamb, frozen offals, bacon and meat products. Although horse, reindeer and whalemeat are imported, they do not come within the definition of "animal" in the Public Health (Imported Food) Regulations, 1937.

Most readers no doubt are already acquainted with the fact that all meat imported into this country must have attached an "official certificate."

"Official certificate" means a certificate, label, mark, stamp or other voucher which is affixed by a competent authority to any overseas meat or meat product, or to a package containing any such meat or meat product, showing that the meat or meat product has

The cutting shop.

been derived from animals inspected ante- and post-mortem and found to be free from disease at the time of slaughter.

It is well to remember that all canned meats must bear the "official certificate" either on the tin or the overall container. The fact that meat has the "official certificate" does not dispense with the necessity of making a further inspection when landed, as various defects may occur during the voyage which require the meat to be reconditioned before it leaves the dock. The causes rendering imported meat unfit can therefore be classed under the following headings:—

Disease, brine damage, bone taint, mould growth, taints, general decomposition, water damage.

Examination of Imported Meat

In brief, the responsibility of a port health authority in regard to imported meat is (a) condition, (b) transport and handling, and (c) compliance with the imported food regulations.

There are three large cold stores owned by the dock company situated in the Royal Albert Dock, with a total storage space of 15,500 tons.

Food Inspection in the Port of London—continued

At No. 6 Cold Store the dock company have provided at the request of the port health authority a "cutting shop," complete with all modern equipment, including a band-saw, thawing slab, electric heater fans for thawing out, and staffed with two skilled butchers. It is in this "cutting shop" where all meats are examined for disease or reconditioned under the supervision of the port health cold store inspector.

It is the practice to send to the cold store inspector samples of meat from each ship for examination, and a percentage of mutton carcases to be glanded for caseous lymphadenitis.

Damaged meat as classified above is sent to number six cold store and reconditioned under the supervision of the cold store inspector. In the case of tainted meats (fruit or oil taint) it is necessary to place in cold store to be treated with ozone generated from an electrical apparatus, the period of time varying from days to weeks for the taint to be removed and the meat fit to be released. This treatment has no deleterious effect on the meat although it causes bleaching.

It is interesting to note that the dressing and examination for disease by some exporting countries shows slackness; and a full justification for examination at the point of landing in this country, where one meets hydated cysts in livers, onchocirciasis in briskets, caseous lymphadenitis, etc.

There has been a considerable stepping up in the imports of chilled meat from South America and New Zealand which is arriving in a satisfactory condition. The meat is carried on the ship (hanging not in a bulk stow) at the average temperature of 29½° F. and, in the case of the latter country which necessitates a long sea voyage 10 per cent. of CO_2 gas is pumped into the chambers.

It is the responsibility of the port health authority to ensure that all meat landed within their district is handled and transported in the best possible manner to prevent contamination and in accordance with the Public Health (Meat) Regulations Part VI—Transport and Handling. To this end care is taken that landing nets, tables and electric trucks are kept clean, and that both rail and road vehicles are clean before loading.

In 1940, the Ministry of Food instituted a system of meat inspection at the ports whereby they stationed a surveyor and inspector at each ship discharging meat to their account, to examine for grade, quality and condition. These officers worked in close liaison with the food inspectors, which resulted in many thousands of tons of unwholesome meat being reconditioned under the supervision of the food inspector before release to the public.

With the handing back of imported meat to the private importer, the Ministry of Food have withdrawn their staff. The port health authority naturally wishes to continue this very close inspection; at the same time appreciating that the existing staff would not be able to stand by each ship discharging, when one considers that eight or more may be discharging at one time. Therefore after careful consideration by the port health committee it was decided to appoint an additional inspector, and two meat watchers, and improved transport facilities for inspectors. The food inspectors on meat duties will have a meat watcher attached to them, so that when damage meat is discharged the food inspector will place the meat watcher at the ship to ensure that all damages are sent to No. 6 cold store in accordance with his instructions to be dealt with by the port health cold store inspector, and thereby preventing any possibility of unsound meat leaving the docks, the inspector continuing to inspect the discharge of meat in his district. The present arrangements will be reviewed from time to time and if necessary additional staff will be appointed, so as to ensure a complete coverage of meat ships.

The port health authority wish to pay tribute to the dock company, the shipping and stevedoring companies, for their wholehearted support and assistance, which enables the port health authority to carry out their duties efficiently and expeditiously in the interest of public health.

The writer wishes to express his appreciation to the Port of London Authority for supplying and allowing reproduction of pictures.

Dockers in an Ageing Population

A Review of Employment Problems of the Older Men

The combined impact of changes in the birth rate with an increased expectation of life, which are characteristic of populations in the industrialised countries of the world, is a matter which has its repercussions both in and outside industry. The problems that may arise in employing older men on their customary jobs are in fact primarily industrial rather than medical. The number of "over sixties" in Britain is steadily increasing, and all industries are affected by this in a greater or less degree.

The age distribution of workers in 32 selected occupations, the shifting pattern of intake, and wastage through various causes in different age groups is examined in a Report* just published by the Nuffield Foundation, in an attempt to avoid speculation and to bring some order and proportion into the statistics and facts of the subject.

The statistical method employed is that of "moving cohorts," that is to say a "cohort" or age group of men at a certain date is taken, and their fate through the succeeding decades is traced. It is not sufficient merely to compare at any moment of time the number of older men with the total number in the occupation. So many fluctuations occur within an industry that the figures may be quite misleading. It is, in fact, necessary to study the fortunes of the same men from period to period. Having compiled tables on the moving cohort principle, it is then possible to review the results and to extract a true picture of the change in age group ratios from one period to another.

Among the occupations which have been examined in this way is that of dockers. It should be mentioned here that what follows refers only to British dockers, and that any conclusions as to age distributions, recruitment and wastage will not be applicable to other countries. Table 1 shows the trend in age distribution within the decade 1921-31.

* "Ageing in Industry" by F. Le Gros Clark & Agnes Dunne, The Nuffield Foundation, London, N.W.1, 1955. Price 6s.

TABLE 1.

1921-31

Age groups	35-44	45-54	55-64	65 +
1921 age-groups b/f to 1931 ...	21,843	29,717	30,284	17,136
1931 ,, working at 1931	25,420	29,174	23,829	6,656
Difference	+3,577	543	6,455	10,480
Retired	147	281	754	3,980
Died	909	2,630	5,127	5,163
Intake ... ... +	4,633	2,368	—	—
Unaccounted for ... ... −	—	—	574	1,337

1931-51

Age-groups	35-44	45-54	55-64	65 +
1931 age-group b/f to 1951 ...	10,730	24,532	25,420	29,174
1951 ,, working at 1951	20,000	23,000	15,200	5,900
Difference	+9,270	1,532	10,220	23,274
Retired	200	300	600	5,900
Died	794	3,062	6,811	16,482
Intake ... ... +	10,264	1,830	—	—
Unaccounted for	—	—	2,809	892

From the above is derived further information. Table 2 shows the ratios of older men, in two groups (55—64 and 65 and over) to those in the broad age group (35—64 years) which is taken stretch from the age at which a man settles to the job which he is going to do for the rest of his working life to the age at which retirement becomes probable.

TABLE 2.

55-64	*1921*	22.0	65 +	*1921*	7.25
	1931	30.5		*1931*	8.5
	1951	26.0		*1951*	10.0

The decrease in numbers employed from 1931—51 is shown in Table 3, and the figures shown under the age groups should be

Dockers in an Ageing Population—continued

read in conjunction with the fact of a total decrease in the numbers as shown in the table.

TABLE 3.
1931-51

Total	Under 35	35-44	45-54	55-64	65+
—30%	—42.5%	—21.25%	—21.25%	—36%	—11.5%

The above tables show the following:—

1. In both 1931 and 1951 an intake in 35-44 and 45-54, and unaccounted for figures in 55-64 and 65+. In 1948 the National Dock Labour Board carried through a combing out of the Dormant Register and removed the names of some 5,000 men who were unlikely to return to the industry; it may be assumed that at least some of these men fell into one or other of the age-groups showing unaccounted for figures.
2. 55-64: The highest ratio is that for 1931. 65+: a steady rise from 1921 onwards, one of the very few occupations plotted which show this tendency.
3. There was a decline in the total and in each individual age-group, the greatest decline being under 35.

Most of the men included within the occupation are now registered with the National Dock Labour Board. But any comparison of figures is complicated by the fact that the Census sub-order does not cover all the varied jobs included within the N.D.L.B. statistics. Moreover, the N.D.L.B. has a register of temporary workers; and it has not been possible to determine how far such men would have regarded themselves as 'dockers,' if they were so employed at the time of the Census. It seems clear, nevertheless, that by the early forties the numbers in regular employment had fallen to approximately 72,000.

The figure for 1931 of over 120,000 may have been somewhat inflated. Men were drifting to the docks in an effort to find work; and there was a considerable amount of part-time employment. During the next few years men were probably leaving the docks, though not at any moment in large numbers. There was no scheme for transferring surplus dock labour to other jobs; and while in 1933 there were only 80,000 registered men the number of casuals seeking a temporary job was possibly still high. To all appearances the trade recession of the thirties inclined a fair proportion of ageing men to retire on the old-age pension and leave what jobs there were for the younger workers.

The position of the older men is now defined by the Dock Labour Scheme. Under the scheme all workers are divided into two groups, A and C, according to their fitness to undertake all the tasks demanded of them. Men over 70 years are all classed as C. The following table indicates the obligations laid upon each of the groups and the guarantee money paid until recently by the Board (there has now been a rise in the guarantee money):

Age-group	Attendances to be proved each week		Attendance money	Guarantee
Under 65	*A*	11	5s. per turn	88s. per week
	C	6	5s. „	48s. „
65-69	*A*	11	5s. „	66s. „
	C	6	5s. „	36s. „
70 and over ...	*C*	6	5s. „	No guarantee

A fair proportion of the men of 65-69 years are no doubt entitled by their age alone to be classed as C. The practice in regard to such men varies from port to port. In some instances it is the custom for the C men to go to a separate call-stand and to be hired therefrom for the less exacting jobs; in others they wait their turn with the rest and would probably find themselves in working gangs as the day proceeds. It falls to the supervisory grades to adjust the work as far as possible to the age and relative agility of the men they are called upon to handle. Dockers as a whole have a high measure of loyalty towards their fellows of any age; and it is usual for them to accommodate an older man even at some risk of loss in their average earnings over a day.

It will be observed that the regulations make it somewhat less attractive for a man to remain at work in his seventies. If there is a shortage of work on the docks, his takings tend to be low. A man aged 65-69 seems to have a certain advantage in that he could decide to attend only six times a week; this would in theory amount to part-time work and enable an ageing man gradually to curtail his efforts. There is, however, a 'continuity' rule that affects dockers of any age. Under this rule a man must complete a job he has once started; and in consequence a C man cannot restrict his hours to the obligatory six calls. He may have to work on continuously through a couple of days or more. A man who could no longer stay the pace would thus have no course but to retire or seek some lighter employment.

Dock work demands a fairly high measure of fitness and agility. Though lighter jobs, as in lamp rooms, warehouses, and gear sheds, are usually reserved for elderly or disabled men, their number is not unlimited. No precise accident figures are available; but it is the view of the Trade Union that the experience of the older men probably saves them in many hazards. The slightly higher fatal accident rate among the older men may be due to a greater risk of succumbing after injury.

Broadly speaking, an ageing docker has a good opportunity of remaining at work as long as he is capable of maintaining a place in a working gang. About 7 per cent. of all dockers were aged 65 and over in 1951, a higher proportion than that recorded at any time in the early thirties. If the Dock Labour Scheme is not yet as flexible as it might be, it at least attempts to establish a practical set of principles for enabling the working time to be adjusted to a man's physical powers. Experience of the plan may show that it can be still further refined. At all events an effort has been made to deal with the problem. There is need meanwhile to study the practices that have grown up in various ports for the handling of the C men. These practices are usually matters of local custom; but they may be found to have some general application.

Having surveyed the conditions in 32 occupations including the dockers, the authors in their concluding remarks proceed to deduce what percentage of men who leave an industry in the middle sixties might have to be provided with alternative and lighter jobs, after making allowances for those who either voluntarily retire, or are forcd to cease work through ill-health. It is suggested that a minimum of 20 per cent. of men of advanced age might have to be provided with alternative jobs suitable to their age, if they are not to be forced by neglect of their needs into a premature retirement. Such are the figures and conclusions based on the 1951 census; the proportion of old people in the working population is likely to increase for some time to come, and with it both the problems both of employment and of alternative employment towards the end of a working life. The report concludes as follows:

"The task is not a simple one; but a country whose population is ageing has to take the matter seriously. Appeals to industry are not sufficient, because most industries are not flexible enough to absorb more than a small proportion of their own human wastage. At the same time it must be realised that only under conditions of high employment will the matter be taken seriously. In a trade recession the older men are almost invariably among the first to go. Everything we have written has been written on the assumption that there will remain a high demand for labour and a reasonable appreciation of the value of ageing men in industry. On that assumption much can be done once the problem has been established on a statistical foundation."

Scheme for New Borneo Port.

A $25,000,000 scheme for the development of a port at Muara, a small fishing village at the northernmost tip of Brunei State in Borneo, has been announced. A development committee has recommended to the State Council that $1,200,000 should be earmarked immediately to allow consultants to go ahead with all necessary surveys, draw up plans and prepare other requirements which will be necessary so that tenders can be invited The State Council has agreed to this and also to earmarking a further $1,000,000 for the acquisition of land in the port area.

The total cost of the port is made up of $17,400,000 for the actual port construction, including dredging, wharfs, godowns, etc., and $7,600,000 for roads, water and electricity supplies, Customs offices and other Government buildings and services. Numerous surveys of the sea bed have to be taken, borings of wharf sites made, and other preparation work undertaken. It is thought to be unlikely that plans could be prepared before the second quarter of 1957, following which a further period of two years or more would elapse before ships would be able to use the new port.

Personalia

National Dock Labour Board Appointments for 1956

The Minister of Labour and National Service announces that, after consultation with the National Joint Council for the Port Transport Industry, he has re-appointed the **Rt. Hon. Lord Crook, J.P.** and **Mr. J. C. Poole, C.B.E., M.C.,** to be Chairman and Vice-Chairman respectively of the National Dock Labour Board for the period 1st January to 31st December, 1956.

He has also appointed the four employers' representatives and four workers' representatives nominated by the National Joint Council for the Port Transport Industry to serve as ordinary members on the Board for the same period.

Following the retirement of **Sir Ian Parkin, C.B.E.** through ill-health, **Mr. M. R. Haddock, O.B.E.** has been appointed General Manager and Secretary of the National Dock Labour Board.

Mr. Haddock, who was educated at St. Paul's School and Magdalene College, Cambridge, received his early training as a Traffic Apprentice with the London and North Eastern Railway and, prior to the war, held appointments at Tyne Dock and in the Port of Hull. He spent the war years in the Transportation Branch of the Royal Engineers, serving mainly with Port Operating Units. He was the Dock Superintendent in charge of the "Mulberry" Harbour, Port Superintendent of Antwerp from 1944 to 1945 and Port Controller of Hamburg from 1945 to 1948, finishing the war with the rank of Colonel. In 1945 he was created an O.B.E. and made an Officer of the Order of Leopold.

From November, 1948 until joining the staff of the National Dock Labour Board he was an Assistant Secretary with the Docks and Inland Waterways Executive.

Mr. Haddock holds the rank of Colonel in the Transportation Staff Pool (Royal Engineers) in the Army Emergency Reserve.

The British Transport Commission announce that **Mr. H. L. Hopkins, C.I.E., O.B.E.,** Port Master Grimsby and Immingham, has been appointed to be Assistant Chief Docks Manager, Humber Ports.

Mr. Hopkins entered the service of the North Eastern Railway in 1919 following military service in the first world war. After training as a traffic apprentice he served at Hull, Carlisle and Gateshead, and was appointed Goods Agent, Leeds, in 1936, moving to a similar post at Leicester in 1938.

During the last war he served as Docks Superintendent, Nantes, up to the time of the evacuation and subsequently was Assistant Director of Docks, Middle East, Deputy Director of Transportation with the British Forces in Greece, and Deputy Director of Transportation in India. In 1944 he was loaned to the Bombay Port Trust as General Manager (docks and railways).

Mr. Hopkins resumed service with the L.N.E.R. in 1946 as Assistant District Goods and Passenger Manager, Ipswich, later becoming District Goods and Passenger Manager, Lincoln. In 1947, he was appointed Port Master, Grimsby and Immingham.

The British Transport Commission announce the appointment of **Mr. W. A. C. Morris,** Assistant Dock Manager, Swansea, South Wales Docks, as Dock Manager, Swansea, with effect from January 1st, 1956. Mr. Morris entered the service of the former Barry Railway Company in the Secretary's office in 1911. In 1923, following the absorption of the South Wales docks and railways by the Great Western Railway Company, he was transferred to Cardiff Docks. He was appointed chief clerk at Plymouth Docks in 1940 and two years later moved to Swansea Docks as head of the general cargo section. He became Assistant Dock Manager at Swansea in 1945.

Mr. A. J. Walden, Staff Assistant, Chief Docks Manager's Office, South Wales Ports, has been appointed Assistant Chief Docks Manager, South Wales Ports. Mr. Walden has had over 35 years' experience at South Wales Ports. He entered the service of the Alexandra (Newport and South Wales) Docks and Railway Company in 1917, and in 1922 was transferred to the newly-formed Chief Docks Managers' Office at Cardiff. In 1933 he became Head of the General Cargo Department at Port Talbot, and subsequently was in charge of the Coal Shipping Department at Newport Docks. He returned to headquarters at Cardiff in 1938 and has been Staff Assistant to the Chief Docks Manager for the last ten years.

Mr. Walden is a member of the South Wales Group of Port Employers, the South East Glamorgan War Pensions Committee and the Cardiff Exchange Club, and has been Chairman of the Area Councils for the permanent staff of the South Wales Docks since their inception in 1948.

From Los Angeles it is announced that **Lloyd A. Menveg** has been re-elected president of Los Angeles Board of Harbour Commissioners. **Vice-Admiral Howard F. Kingman, U.S.N. (Retd.),** has been re-elected vice-president.

A further appointment is that of **Rear-Admiral Edward V. Dockweiler, U.S.N. (Retd.),** who has been appointed chief engineer of the Los Angeles Harbour Department.

Ports Efficiency Committee Changes

The following changes have taken place in the membership of the Ports Efficiency Committee, which meets under the chairmanship of Sir Ernest H. Murrant, K.C.M.G., M.B.E., Chairman of Furness Withy & Co., Ltd.

Sir Douglas Ritchie, M.C., has resigned on account of ill-health, and Mr. F. A. Pope, C.I.E., has resigned on ceasing to be a full-time member of the British Transport Commission.

The Minister of Transport and Civil Aviation has appointed the following new members to the Committee: Sir Robert Letch, General Manager of the Docks Division of the British Transport Commission and Chairman of their Docks Board of Management; Sir Eric Millbourn, C.M.G., Hon. Adviser to the Minister on Shipping in Port; Mr. Leslie E. Ford, O.B.E., General Manager of the Port of London Authority. Mr. Ford has received a knighthood in the 1956 New Year Honours.

The Committee was appointed by Lord Leathers in March, 1952, with the task of securing improvements in the flow of cargoes through United Kingdom ports. It now reports to the Minister of Transport and Civil Aviation. The other members of the Committee are Mr. M. Arnet Robinson, Chairman of the Mersey Docks and Harbour Board, Managing Director of Coast Lines Ltd., and Mr. Tom Yates, C.B.E., General Secretary of the National Union of Seamen. The Secretary of the Committee is Mr. R. R. Goodison of the Ministry of Transport and Civil Aviation.

The Committee is now investigating at the request of the Minister the problems involved in delays to road vehicles at docks.

Manufacturers' Announcements

New Thames Transporter

A Twin Screw Diesel engined landing craft has recently been completed by Thames Launch Works Ltd., of Eel Pie Island, Twickenham, for the Petroleum Development Company (Oman) Ltd.

The vessel is for service in the Middle East and will be used for the carriage ashore of lorries carrying oil well equipment which will be loaded direct from ships lying out in deep water. The ramp bow will obviate any further handling of the gear until arriving at the precise destination.

Designed by R. C. W. Courtney, A.M.I.N.A., of Courtney, Hughes & Partners Ltd., the transporter has an overall length of 60-ft., moulded breadth 16-ft. 6-in., and moulded depth of 6-ft.

She is capable of carrying loads up to 30 tons on a draught of 3-ft. 6-in. During trials the craft attained a mean speed over a measured course of 7.98 knots, and using the rudders flat she completed the turning circle in approximately 150-ft. in 1 min. 5 sec. Using engines, the full circle was completed in her own length in 57 secs.

The hull is of all welded steel with $\frac{1}{4}$-in. shell and deck plating, 3 x $2\frac{1}{2}$ x 5/16-in. and $2\frac{1}{2}$-in. x 2-in. x $\frac{1}{4}$-in. frames spaced 18-in. apart and $\frac{1}{4}$-in. vehicle deck. Heavy skeg plates are arranged aft and the bottom is reinforced with five external rubbers of $2\frac{1}{2}$-in. x 1-in. convex bar.

Propelling machinery consists of two Gleniffer diesel engines, type DH4 each developing 80 b.h.p. at 900 r.p.m. with direct drive reverse gear and de-rated for operating under tropical conditions. Fresh water cooling is provided with external heat exchangers and the controls are lead to the steering position. Three Giljector pumps each having a capacity of 30 gollons per minute and driven from the engine power take offs are installed at the forward end of engine room for operating the fresh water, ballast and bilge systems.

An unusual feature of the vessel is the incorporation of a funnel in the after part of the wheelhouse from which the exhausts are discharged after passing through Burgess silencers. The engine room is ventilated by four 12-in. diameter cowl vents.

Development of Port of Salaverry, Peru

It has recently been announced that Messrs. George Wimpey and Co. Ltd., have obtained a contract for constructing a port at Salaverry, which lies 320 miles north of Lima, the capital of Peru. It is estimated that the works will cost approximately £2.2 mn. and will take three years to complete. A 4,500-ft. breakwater, with a mole 450-ft. in length, is to be constructed, together with access roads, warehouses, rail tracks and other facilities. Locomotives and cranes will be supplied.

Fireproof Doors for Warehouses

The importance of adequate and fireproof doors for warehouses and dockside sheds need hardly be emphasised, although it happens only too often that a fire could have been isolated, and damage minimised by proper provision. For this purpose steel doors are much to be preferred to other types, inasmuch as resistance to fire is combined with robustness in construction and the capacity to stand hard usage and, within limits, impact of vehicles. A range of such fireproof doors is manufactured by John Booth & Sons (Bolton) Ltd., who have specialised for many years in the production of varied types for use both externally and in subdivision of sheds and staircases.

While the maximum area permissible for a fireproof door is normally 56 sq. ft., the Fire Office Committee has tested a Booth Sureshield Fireproof Door of 90 sq. ft. at 2,000 deg. Fahrenheit for three hours. The test was successful enough for permission to be obtainable to use these doors for large openings when such are essential.

As an alternative to the above, the Company produces also the Booth Sureshield Fireproof Steel Rolling Shutter, and many dock warehouses are fitted with these, both in respect of the division walls and of the outside openings. Also in this range are special fireproof doors for the protection of openings through which a crane normally works, on Cotton Safes or Stores, with a hinged flap to cover the full width of the crane opening and vertical or sliding hinged folding doors to cover the opening for the crane cabin and for the passage of goods.

Tugs for Singapore

The first of two 1360 B.H.P. twin-screw tugs, the "Berguna," built by Messrs. Clelands (Successors) Ltd., of Wallsend-on-Tyne, for the Shell Company of Singapore, recently arrived there under her own power. Powered by two Crossley type "H.G.N.8/34" unidirectional Scavenge Pump Diesel engines, each arranged to develop 680 B.H.P. continuously at 340 R.P.M., the "Berguna" has an overall length of 111-ft., a B.P. length of 100-ft., a moulded breadth of 28-ft. and a moulded depth of 14-ft. On trials the vessel attained a speed of 12.27 knots and a maximum towing pull of $14\frac{3}{4}$ tons.

Particular attention has been paid to the fire fighting requirements at Singapore. Three powerful "Pyrene" foam monitors are supported on a "Safe-tread" flooring walkway between the wheelhouse top and special aft platforms on the port and starboard sides.

"Pyrene" portable type mechanical foam generators with the necessary dividing breaching nozzles and connections to foam tanks have been arranged and connected to two large fire pumps, each comprising a Crossley type "B.W.5" diesel engine developing 110 B.H.P. at 1500 revs. per minute, the engines being started by compressed air.

An interesting feature of the machinery installation is the remote control from the wheelhouse, consisting of four control pedestals, two on the bridge, one on the wheelhouse top and one abaft the funnel, with the necessary connections to the engines for operating the engine controls, and also the control of the reverse reduction gear boxes from the Chadburn telegraphs.

A sister vessel with identical machinery is now being built by Messrs. Ferguson Bros. (Port Glasgow) Ltd.

Oil Tank Fire Control

A 20-minute colour film called "Beneath the Flames," was presented recently in London by the Mobil Oil Company (formerly the Vacuum Oil Company), showing air agitation as a means of controlling and extinguishing oil tank fires. Air is injected into the bottom of the tank inducing an upward flow from the colder body of the oil and thus cooling the surface the burning liquid. This cooling is sufficient to extinguish fires of high flash point oils, and reduces the severity of low flash point oils so that they can be extinguished by ordinary methods, such as foam.

Included in the film are shots of one of the biggest test fires ever made, where a tank containing 2,000,000 gallons of home heating oil was set on fire. Compressed air was passed into the bottom of the tank, and in less than two minutes the flames, which had risen to a height of 50-ft., were extinguished.